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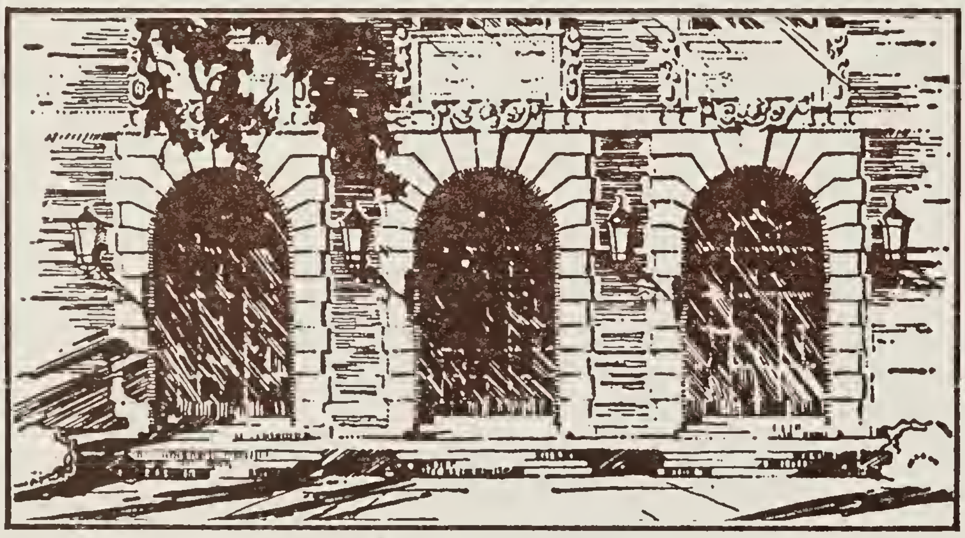

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The Coleopterists' Bulletin

A QUARTERLY PUBLICATION DEVOTED TO THE STUDY OF BEETLES

VOLUME 21, 1967

DEPARTMENT of ENTOMOLOGY
PURDUE UNIVERSITY
LAFAYETTE, INDIANA 47907

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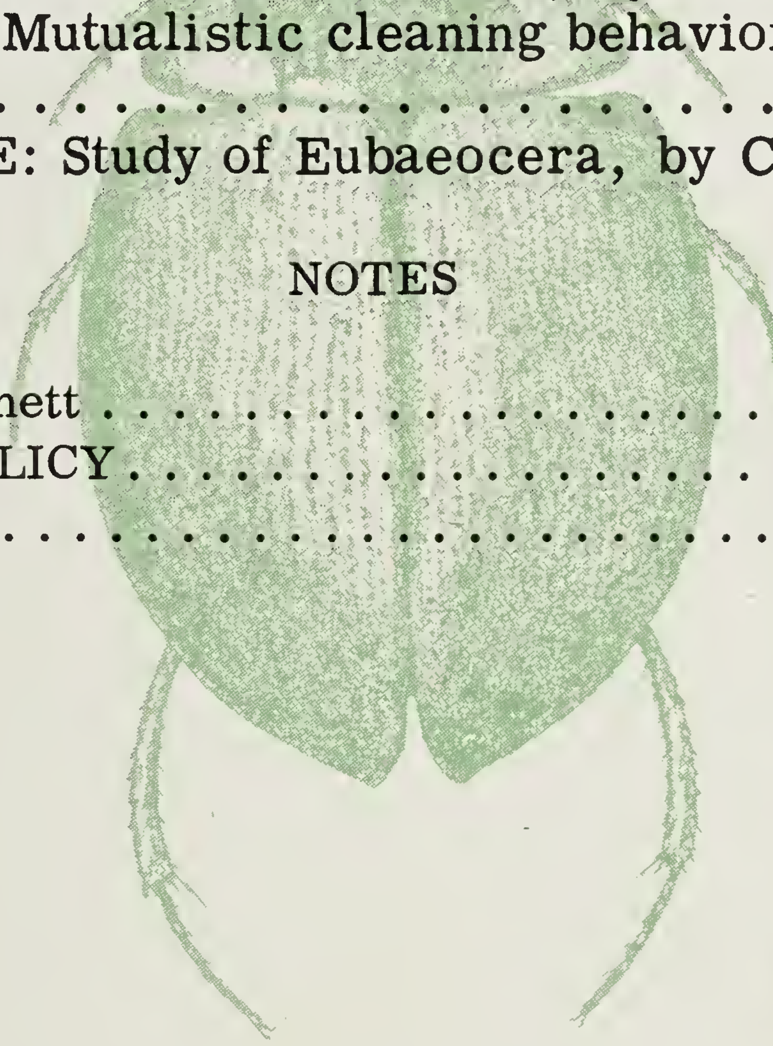

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(Continued on back inside cover.)

THE COLEOPTERISTS' BULLETIN

VOLUME 21 MARCH 1967 NO. 1

A TAXONOMIC STUDY OF EUBAEOCERA NEW GENUS (COLEOPTERA: SCAPHIDIIDAE) IN NORTH AMERICA NORTH OF MEXICO[1]

By JAMES FRASER CORNELL, JR.[2]

Eubaeocera is a widely distributed genus of fungivorous beetles. Because of their small size and concealed habitats—under rotting logs, on mushrooms, in sawdust piles—and their rather uniformly drab appearance, few specimens are collected, although they are almost ubiquitous inhabitants of the forest floor. I have collected specimens by black light, sweeping, sifting, and aspirating, but the most satisfactory method for obtaining *Eubaeocera* and other Scaphidiids is by the "Berlese" method with a modified Tullgren funnel.

The species of *Eubaeocera* within the scope of this study are readily characterized by the shape of the male genitalia. The internal genitalic structures—flagellum, flagellar guide-sclerite, and internal sac—are of use in defining the species and moreover in showing relationships among species, but are generally not shown in the figures for the species since, excepting a few cases, they unnecessarily complicate the figures. The internal guide for the flagellum is shown for *E. cerbera, E. securiforma, E. deflexa, E. youngi,* and *E. congener.*

The terminology used below for the genitalia is mainly from Tuxen (1956) with the following exceptions. Aedeagus here refers to the entire male organ; that is, the lateral lobes or parameres, and the median lobe or penis. A new term, flagellar guide-sclerite, is employed for a dorsal, internal sclerite which apparently functions as a guide for the functional intromittent organ, the flagellum.

The dorsal length of the body was measured from the anterior edge of the head to the posterior median edge of the elytra at rest. This measurement was made at 12.5X with an ocular micrometer while the ventral maximum length of the aedeagus was measured at 50X.

It proved to be impossible to associate the female types of Casey's *Baeocera texana* and *B. discolor,* and the incomplete male type of *B. robustula* with existing or new species. These are considered *nomina dubia* as it is better to risk having one of the new species placed in synonymy than to add misidentifications to the literature.

Acknowledgments. I acknowledge my indebtedness to the many institutions and individuals who generously loaned specimens of Scaphidiidae: American Museum of Natural History, Mrs. P. Vaurie; University of Arizona at Tucson, Dr. F. G. Werner; California Academy of Sciences, Mr. H. B. Leech; Canadian National Collection, Dr. H. F. Howden; Chicago Natural History Museum, Dr. H. S. Dybas; Illinois Natural History Survey, Mrs. L. Gloyd; Iowa State University, Dr. J. Laffoon; Museum of Comparative Zoology, Dr. J. F. Lawrence; North

---

[1] Contribution from the Entomology Department, North Carolina Agricultural Experiment Station, Raleigh, North Carolina. Published with the approval of the Director of Research as Paper No. 2146 of the Journal Series.

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Carolina State University, Dr. D. A. Young; Ohio State University, Dr. C. A. Triplehorn; Ontario Agricultural College, Dr. D. Pengelly; Snow Entomological Museum of the University of Kansas, Dr. G. Byers; U. S. National Museum, Dr. J. M. Kingsolver. Mr. W. Rosenburg, Mr. Joe Schuh, and Mr. Vernon Kirk loaned material from their personal collections.

I am particularly indebted to Dr. R. Bénard of the Museum National d'Histoire Naturelle, Paris, who kindly searched for the type specimen of *Scaphidium concolor* F., to Dr. Fritz Hieke of the Zoologisches Museum der Humboldt Universitat, Berlin, for loaning the three specimens of *Baeocera concolor* (F.) studied by W. F. Erichson, and to Dr. Leland Chandler of Purdue University who sent me the lectotype series of *Scaphisoma punctipennis* Blatchley.

Eubaeocera Cornell, NEW GENUS

Baeocera of authors, not Erichson 1845.

TYPE-SPECIES: *Baeocera abdominalis* Casey, 1900, by present designation.

The species in the present study would be referred to the genus *Baeocera* by recent workers, but *Baeocera* Erichson 1845 cannot be so used for the following reasons. Erichson originally designated *Scaphidium concolor* Fabricius 1801 as the type-species for the genus *Baeocera*. Achard (1920) studied the type specimen of *Scaphidium concolor* F. then in the Bosc collection in the French National Museum of Natural History, and stated that it was a specimen of the species *Cyparium flavipes* LeConte 1860, and made *C. flavipes* a junior synonym of *S. concolor*. For unknown reasons he then renamed *B. concolor* (F.) as *Baeocera falsata* Achard. I have learned[3] that the type specimen of *Scaphidium concolor* F. has been lost from the collections of the museum in Paris.

In the interest of stability of nomenclature of *Baeocera, Scaphidium* and *Cyparium*, the following actions are taken here. First, as lectotype of *Cyparium flavipes* LeC., a female specimen in the LeConte Collection now housed at the Museum of Comparative Zoology, Harvard University is selected. This specimen, one of a series of syntypes, bears a small orange paper circle on the pin, a code indicating the specimen is from the southern states. It also bears the MCZ type label Number 6635. The specimen is topotypic and one of LeConte's type series. I have dissected the specimen. The genitalia are in a microvial on the pin bearing the specimen; one antenna is mounted on a microscope slide bearing the original information plus the type number. Both the pin mount and the slide are labeled "Lectotype of *Cyparium flavipes* LeC." Secondly, the lectotype female of *Cyparium flavipes* LeConte is presently selected as the neotype of *Scaphidium concolor* Fabricius. This specimen from the "Southern States" conforms to the type locality of *S. concolor* stated by Fabricius (1801) as being from "Carolina." As a result of this, *concolor* and *flavipes* become objective synonyms with Achard's (1920) action as first reviser. The name *Baeocera* Erichson cannot be correctly applied to the species treated below. The new genus *Eubaeocera* is erected here for *Baeocera* of workers later than Erichson.

Baeocera punctipennis Blatchley 1910, a primary homonym of *B. punctipennis* Matthews 1887, was renamed *B. blatchleyi* Achard (Achard, 1915). Through the courtesy of Dr. Leland Chandler of Purdue University I was able to dissect the lectotype and paralectotypes of this species and on the basis of these dissections *Baeocera blatchleyi* (Achard) is here transferred to *Scaphisoma*

---

[3] Dr. Roland Bénard, Museum National D'Histoire Naturelle, Paris, France (personal communication, January 7, 1965).

Leach as *Scaphisoma blatchleyi* (Achard), **NEW COMBINATION**, a change that will not affect the status of *Scaphisoma punctipennis* (Matthews, 1887) earlier transferred to *Scaphisoma* from *Baeocera* by Champion (1913).

Diagnosis. Size small to minute, from 0.9 mm to 2.8 mm long, oval with body fusiform, convex above and beneath, legs progressively longer from the first to the third pair, coxae of each pair widely and about equally separated.

Description. Head deflexed, weakly subquadrate, rounded, slightly wider at middle of eyes than at posterior margin, glabrous; labrum and clypeus about one-third greatest width of head, slightly shorter than head, with minute setae sparsely scattered over surface; eyes large, coarsely granulate, each slightly emarginate along inner margin at antennal insertion; antenna as in Figure 1G, inserted on margin of front in small fovea, segments moderately to sparsely setiferous, with apical 3 segments forming a loose club; frontoclypeal suture distinct, curving basad and under antennal insertions; epistomal suture less distinct than frontoclypeal suture, straight; mandible, labium, and maxilla as in Figures 1F, 1E, and 1D.

Pronotum with width nearly 3 times greatest width of head, almost semicircular in outline, but with anterior margin slightly concave, posterior margin with distinct rounded median lobe, each lateral margin with linear prominence which becomes obsolete at anterior and posterior margins, pronotum projecting laterally under elytral humeri and partially obscuring mesepimera, surface shining throughout, sparsely to moderately punctate or punctulate, punctures each bearing fine decumbent seta. Scutellum present, visible or concealed.

Elytra truncate, moderately convex, slightly widened just before middle, strongly margined along elytral suture, these striae or margins extending entirely around each elytron except at posterior margin, inner apical elytral edges serrate for short distance, surface sparsely covered with more or less regular rows of small decumbent setae set in punctures. Prosternum small, approximately 4 times as wide as long; mesosternum small, approximately 3 times as wide as long; metasternum larger, approximately twice as long as wide, with slightly pubescent median depression which is more pubescent in male than in female.

Legs: Front coxae conical, prominent; middle coxae conical, not prominent; hind coxae transverse, coxae of each pair widely separated; trochanters small. Front leg with femur broad, with row of prominent spines along inner edge; tibia narrower, with setae and spines along inner and outer margins, and 2 large spurs at apex; tarsus very pubescent, with basal 2 tarsomeres weakly lobed, the next 3 narrower. Middle and hind legs each with 1 row of small widely spaced setae along inner edge of femur, with tibia narrow and more densely spiny and setiferous, less densely so on hind tibia than on middle tibia; tarsi with all 5 tarsomeres narrow and pubescent.

Abdomen with 6 visible segments, occasionally more when genitalia strongly extruded, first abdominal segment as long or longer than the next 3 combined, expanded anteriorly in blunt lobe between hind coxae, acetabulae with row of somewhat elongate-oval punctures, segments 2 through 6 progressively smaller, segment 6 modified by median apical lobe, which is more prominent in males than females.

Aedeagus (structures shown in Figures 1A, B) articulate, large, almost filling body cavity; basal half of median lobe expanded, bulbous, apical half narrower; parameres inserted ventrally on bulbous base of median lobe, long and narrow, curving mesad at apex; internal structures more or less heavily sclerotized, consisting of functional intromittent organ, flagellum, and dorsal flagellar guide-sclerite, with internal sac present in some species and ornamented variously with spikes, plates and setae.

Female genitalia with coxite expanded apically from narrow beginning to abrupt lobe at apex, the style a short nipple-like protuberance bearing long apical seta.

Color: Mostly shining black, legs, mouthparts, antennae, and under surface, and apical margin of elytra of many species yellowish to rufous.

Relationships. *Eubaeocera* may be separated from *Toxidium* LeConte which has approximate coxae by its widely spaced coxae. *Eubaeocera* with the third antennal segment long and cylindrical, and the galea of the maxilla acuminate, rounded, with long, widely spaced setae, differs from *Scaphisoma* in which the third antennal segment is subtriangular and short, and the galea of the maxilla widened apically, securiform, with short closely set setae in regular rows. Females of *Eubaeocera* may be separated on genitalic characters from both *Scaphisoma* and *Toxidium* in both of which the coxite is long, narrow, cylindrical, while in *Eubaeocera* the coxite is long and distinctly clubbed at apex.

KEY TO MALE EUBAEOCERA

1. Elytra with maculae at humeri and apices dull red; aedeagus (figs. 2N, 4B) .... HUMERALIS (Fall)
   Elytra immaculate; aedeagus not as above 2
2. Aedeagus with a ventral median keel on basal portion of median lobe 3
   Aedeagus with no ventral median keel on basal portion of median lobe 5
3. Median lobe narrowing abruptly distally, not bent sharply ventrad at apex (figs. 2E, 4E) .... ABDOMINALIS (Casey)
   Median lobe narrowing gradually distally, or expanded at apex, bent abruptly ventrad at apex 4
4. Parameres broad at apex, acuminate, not curving around and over apex of median lobe (figs. 2D, 3J) .... KINGSOLVERI n. sp.
   Parameres broad, truncate at apex, curving around and over apex of median lobe (figs. 2B, 3K) .... DYBASI n. sp.
5. Length of specimen from anterior margin of head to posterior margin of elytra 1.7 mm. or more 6
   Length of specimen from anterior margin of head to posterior edge of elytra 1.6 mm. or less 10
6. Scutellum visible when prothorax normally[1] adjusted to elytra, aedeagus with longer dorsal arm of flagellar guide-sclerite securiform at apex (figs. 3A, 3D) .... SECURIFORMA n. sp.
   Scutellum not visible, flagellar guide-sclerite not as above 7
7. Aedeagal flagellar guide-sclerite with a distinct protuberance on ventral margin of longer, dorsal arm (figs. 2M, 3L) .... YOUNGI n. sp.
   Aedeagal flagellar guide-sclerite without distinct protuberance on ventral margin of longer dorsal arm, not as in above figure 8
8. Aedeagus with flagellum long, slender, sharply angulate near midlength; flagellar guide-sclerite apex broadly bifid (figs. 3B, 3C) .. DEFLEXA (Casey)

---

[1] Normally adjusted means closely fixed to the elytra; when specimens are dissected the scutellum is often exposed by unnaturally separating the prothorax from the bases of the elytra. The scutellum is best seen in direct illumination from the side adjusted so as to cast shadows.

Aedeagus with flagellum in form of broad, twisted, reclining, Arabic numeral "6," not sharply angulate near midlength, flagellar guide-sclerite bifid or not at apex 9

9. Aedeagus short and broad in ventral aspect; parameres broad, sinuate on outer margin at base only; flagellar guide-sclerite with longer, dorsal arm bifid at apex (figs. 3E, 3I) .... CERBERA n. sp.

Aedeagus narrower, not short and broad, in ventral aspect, parameres broad, sinuate along inner and outer margins; flagellar guide-sclerite with ventral margin overhanging dorsal margin, forming a notch (figs. 2A, 3H) .... CONGENER (Casey)

10. Parameres broad, in lateral aspect, truncate at apex, with tooth on inner margin in ventral aspect, median lobe apex and internal structures complex (figs. 2K, 3G) .... MITCHELLI n. sp.

Parameres narrow, in lateral aspect not truncate at apex, not as in above figure 11

11. Parameres in ventral aspect with inner and outer margins subparallel, without curved notch on inner margin just before apex 12

Parameres in ventral aspect with inner and outer margins subparallel, with curved notch on inner margin just before apex 15

12. Scutellum not visible when pronotum normally adjusted to elytra, aedeagus (figs. 2F, 4F) .... APICALIS (LeConte)

Scutellum visible when pronotum normally adjusted to elytra, aedeagus not as in above figure 13

13. Parameres in lateral aspect not expanded at apex; flagellum an asymmetrically curved, thick spiral with apex bent abruptly dorsad (figs. 21, 3F) .... NANA (Casey)

Parameres in lateral aspect expanded somewhat at apex, flagellum not an asymmetrically curved, thick spiral with apex bent abruptly dorsad, not as in above figure 14

14. Parameres in lateral aspect expanded strongly ventrally, flattened dorsally; apex of median lobe not crenulate, in lateral aspect excavated ventrally (figs. 2G, 4K) .... EURYDICE n. sp.

Parameres in lateral aspect expanded slightly dorsally and ventrally; apex of median lobe finely crenulate, in lateral aspect excavated dorsally (fig. 2H, 3M) .... PALLIDA (Casey)

15. Aedeagus in lateral aspect with dorsal posterior edge at ostium appearing multilayered; parameres long, slender (figs. 2L, 4A) .... PICEA (Casey)

Aedeagus in lateral aspect with dorsal posterior edge at ostium appearing single-layered; parameres variable 16

16. Parameres in lateral aspect, narrow, subparallel-sided, apex not distinctly narrowed; flagellum with a distinct anterodorsally directed "heel" at angle (figs. 2J, 4C) .... CHARYBDA n. sp.

Parameres in lateral aspect broader, sinuous, apex distinctly narrowed ventrally; flagellum with very slight or no anteroventrally directed "heel" at angle (figs. 2C, 4D) .... SCYLLA n. sp.

Eubaeocera abdominalis (Casey), NEW COMBINATION

Baeocera abdominalis Casey, 1900:58.

Length 1.0-1.2 mm. Scutellum not visible; antenna (Figure 2N); aedeagus (Figures 2E, 4E), 0.45 mm long, median lobe long, narrow, tapering distally but slightly expanded at apex, a median ventral keel present on basal portion of median lobe (keel may be so transparent as to be almost invisible in some specimens); parameres large, acuminate, each broadly curved on outer margin, inner margin nearly sinuate; internally with flagellum long, slender, curved abruptly dorsad at apex, flagellar guide-sclerite small with anterior edge broadly curved dorsad, posterior edge with two protuberances, one projecting caudad, the other dorsad.

The writer dissected the type specimen which is in the U.S.N.M., T. L. Casey Collection. The type is from Tyngsboro, Massachusetts; additional specimens were examined from Maine, Massachusetts, Maryland, New Jersey, North Carolina, and Illinois.

Eubaeocera abdominalis (Casey) closely resembles *E. kingsolveri* n. sp., but differs from that species in having a narrower median lobe that is not fluted at the apex.

Eubaeocera kingsolveri Cornell, NEW SPECIES

Length 1.3 mm. Scutellum not visible; antennae as in Figure 4O. Aedeagus as in Figures 2D, 3J, 0.54 mm long, median lobe broad, not tapering, apex a ventrally curving expanded lobe subtended laterally by 2 narrow slits, basal portion with prominent median ventral keel; parameres each thick, extending well beyond apex of median lobe, in ventral view with margins subparallel, a row of 4 to 6 denticles on outer margin just before apex; internally with flagellum long, slender, curving abruptly ventrad at apex, flagellar guide-sclerite large, bent abruptly dorsad at both ends.

Holotype male, near Aberdeen, North Carolina, 8 Oct. 1964 (J. F. Cornell and T. B. Mitchell) from abandoned gravel pit. The specimen was collected in a modified Tullgren funnel together with *E. mitchelli* n. sp. and *E. abdominalis* (Casey), from a mixed clump of moss, reindeer lichen, and two small agaricine mushrooms. One paratype, Tallula, La. (J. W. Folsom) 19 VI 1934. Type on indefinite loan to the U. S. National Museum from N. C. State University, paratype in Museum of Comparative Zoology.

E. kingsolveri n. sp. resembles externally *E. abdominalis* (Casey), both lacking a scutellum and being rather roundly oval in outline, but may be readily distinguished by the characters discussed under *Eubaeocera abdominalis* (Casey).

I take pleasure in naming this species after Dr. John M. Kingsolver who was very helpful to me during the course of this study.

Eubaeocera dybasi Cornell, NEW SPECIES

Length 1.5-1.6 mm. Scutellum visible, large; antennae as in Figure 4I. Aedeagus as in Figures 2B, 3K, 0.85 mm long, with a prominent median ventral keel on basal portion of median lobe, median lobe tapering broadly to distal end, then enlarged and recurved ventrad, a shallow median trough extending from just before posterior base of paramere to apex of median lobe, and ornamented internally on both sides just before apex with a crenulate rounded process on a short stalk arising from outer walls of trough; parameres each broadly curved on inner and outer margins, curving around and over the apex of median lobe, extending well beyond apex of median lobe, in lateral aspect with apex truncate; internally with flagellum large, bluntly rounded at apex, flagellar guide-sclerite large, expanded at posterior end, tapering distally to broad point.

Holotype male, San Diego, Texas, 8.12 (Hubbard and Schwarz), one topotypic paratype, 9.12 and one paratype, Beeville, Texas, 3.11 (Hubbard and Schwarz). Type and second paratype in U.S.N.M. First paratype in author's collection.

Eubaeocera dybasi n. sp. is readily distinguished from all other species in the genus by its truncate parameres that curve around and over the median lobe.

I take pleasure in naming this species after Dr. H. S. Dybas who has been very encouraging to me during this study.

Eubaeocera apicalis (LeConte), NEW COMBINATION

Baeocera apicalis LeConte, 1860:328.

Length 1.2-1.4 mm. Scutellum not visible; antenna as in Figure 4L. Aedeagus as in Figures 2F, 4F, 0.50 mm long, median lobe rather narrow, with ventral margin of basal portion flattened, apex broad, sculptured dorsally at base of parameres and just posterior to that point with faint embossed lines which partly encircle narrower portion of median lobe; parameres narrow, curving strongly mesad, not expanded apically in lateral view; internally with flagellum shaped like a reclining Arabic numeral "6," bifurcate just beyond middle, flagellar guide-sclerite produced anteriorly and ventrally as a narrow lobe, curving dorsad of and extending along flagellum, apex thicker and shallowly bifid.

The type specimen in the LeConte Collection at M.C.Z. has been dissected by the writer. The type is from "Southern States." Additional specimens have been seen from Maine, Connecticut, Massachusetts, Pennsylvania, New Jersey, Virginia, North Carolina, Michigan, Illinois, Indiana, Kentucky, and Missouri.

Eubaeocera apicalis (LeConte) closely resembles *E. pallida* (Casey) and *E. eurydice* n. sp. However, it does not have a visible scutellum as do these two species, and its broad unexpanded parameres differ from the narrow ones of the two mentioned species.

Eubaeocera pallida (Casey), NEW COMBINATION

Baeocera pallida Casey, 1900:58.

Length 1.2-1.4 mm. Scutellum visible, minute; antenna as in Figure 4M. Aedeagus as in Figures 2H, 3M, 0.35 mm long, median lobe tapering to a point, the apex crenulate; parameres each extending just beyond apex of median lobe, narrow, slightly expanded dorsally and ventrally in lateral aspect, and with margins subparallel in ventral aspect; internally with flagellum similar to *E. apicalis* (LeConte), curving sharply ventrad at apex, flagellar guide-sclerite present.

The type specimen in the T. L. Casey Collection at the U.S.N.M. was dissected by the writer. The type locality is near Philadelphia, Pennsylvania; additional specimens have been examined from Missouri and Tennessee.

The aedeagus of *E. pallida* resembles that of a minute *E. apicalis* (LeConte) but may be readily differentiated therefrom by its dorsoventrally expanded parameres in lateral aspect and the crenulate apex on its median lobe. It further differs from *E. apicalis* (LeConte) in having a minute visible scutellum.

Eubaeocera eurydice Cornell, NEW SPECIES

Length 1.1-1.2 mm. Scutellum visible, minute; antenna as in Figure 4S. Aedeagus as in Figures 2G, 4K, 0.26 mm long, basal portion of median lobe flattened ventrally, a broad notch on dorsal margin at about middle, median lobe tapering to rounded apex; parameres each extending well beyond apex of median lobe, in lateral aspect, ventral margin, distinctly broadened ventrally before apex, dorsal margin flattened, in ventral aspect subparallel-margined, broad; internally with flagellum similar to *E. apicalis* (LeConte), flagellar guide-sclerite broadly lobed at base, narrower at posterior apex.

Holotype male, Santa Rita Mountains, Arizona, 15.6 (Hubbard and Schwarz). Two paratypes, one topotypic, 16.6 in the author's collection, and one Chiricahua Mountains, Arizona, 2.7 (Hubbard and Schwarz) with the number 1222 on the pin-label, in U.S.N.M.

Eubaeocera eurydice n. sp. most closely resembles *E. pallida* (Casey) and *E. apicalis.* Besides the distinguishing characters given in the key and in the discussion of the latter two species, *E. eurydice* has a smaller aedeagus.

Eubaeocera picea (Casey), NEW COMBINATION

Baeocera picea Casey, 1893:516.

Length 0.1-1.4 mm. Scutellum visible; antenna as in Figure 4J. Aedeagus as in Figures 2L, 4A, 0.60 mm long, median lobe narrowing sharply beyond basal portion then expanding gradually to form a broadly rounded apex ventrally, dorsally with margin narrower, notched deeply at apex, with darker sclerotized area along ventral margin of apical portion of median lobe forming shallow trough along ventral surface of median lobe; ostium covered by flaps arising from distal sides of median lobe; these in lateral aspect giving a characteristic multi-layered appearance to posterior dorsal edge of median lobe; parameres extending well beyond median lobe, in ventral aspect curving broadly, margins subparallel, a shallow curved notch on inner margin just before apex, inner margin transluscent to transparent in distal half, covered with minute pores; internally with flagellum long slender, abruptly bent ventrad about at base of apical one-third, the angle not produced anteriorly or dorsally, flagellar guide-sclerite large, asymmetrical.

The type specimen in the T. L. Casey Collection at the U.S.N.M. was dissected by the writer. The type is from Pennsylvania; additional specimens have been examined from Maine, Massachusetts, Michigan, Wisconsin, New York, Illinois, Indiana, New Jersey, District of Columbia, West Virginia, North Carolina, and South Carolina.

Eubaeocera picea (Casey) may be separated from most other species by the apparently lamellate posterior dorsal margin of the median lobe. The lack of a "heel" on the flagellum separates it from both *E. scylla* n. sp. and *E. charybda* n. sp.

Eubaeocera scylla Cornell, NEW SPECIES

Length 1.1-1.4 mm. Scutellum present, ogival, distinct; antenna as in Figure 4G. Aedeagus as in Figures 2C, 4D, 0.45 mm long, median lobe tapering abruptly to a broadly angular apex, with darker sclerotized area along ventral margin extending from apex to just before bulbous basal portion of median lobe, darker zone about one-third width of median lobe; parameres each in ventral aspect with margins subparallel, a distinct curved notch on inner margin just before apex, in lateral view with dorsal and ventral margins sinuous, ventral margin converging to dorsal margin making the apex noticeably narrowed; internally with flagellum long, slender, sharply angled at about posterior one-third of length and directed abruptly ventrad, angle only slightly if at all produced either anteriorly or ventrally as a slight "heel," flagellar guide-sclerite large, asymmetrical.

Holotype male, Whispering Pines (Near Southern Pines), Moore County, North Carolina, 8 Oct., 1964 (J. F. Cornell and T. B. Mitchell) from litter under oak and pine logs, on indefinite loan to U. S. National Museum from N. C. State University. Paratypes: seven topotypic paratypes, same data as type, deposited in the U. S. National Museum, Museum of Comparative Zoology, Chicago Natural History Museum, N. C. State University Collection, and the author's collection; three N. C. Pender Co. nr. Ivanhoe, 11, VI, 1964 (J. F. Cornell & C. D. Mampe) from pine slab pile, in Oregon State University Collection, California Academy of Science collection, and the author's collection; two N. C. Wake Co., Raleigh, 9 May 1964 (J. F. Cornell) from pine logs and litter; two N. C. Reedy Creek State Park, 16 April, 1964 (J. F. Cornell and G. Matuza) from trash under pine logs; one N. C. Holly Shelter Game Refuge, 24 IX, 1964, (J. F. Cornell and T. B. Mitchell) from pine-oak logs and litter; and one N. C. Sampson Co. 6 miles N. Salemburg on N. C. 242, 2 V, 1964, (J. F. Cornell) from oak-pine logs, all in the author's collection; and one N. C. Wake Co., Raleigh, 25 April, 1964, (J. F. Cornell and B. S. Heming) from deciduous woods trash in Ohio State University Collection.

Eubaeocera scylla n. sp. closely resembles *E. charybda* n. sp. and *E. picea* (Casey). It differs from *picea* in having a single layered posterior edge to the median lobe, *picea* having a multi-layered edge. It differs from *charybda* in having sinuate rather than straight parameres, a wide sclerotized area on the ventral margin of the median lobe, and by lacking a pronounced "heel" at the angle on the flagellum, *charybda* having such a "heel."

Eubaeocera charybda Cornell, NEW SPECIES

Length 1.2-1.4 mm. Scutellum visible, distinct; antenna as in Figure 4P. Aedeagus as in Figures 2J, 4C, 0.63 mm long, with median lobe tapering to rounded apex, a darker sclerotized area extending from apex of median lobe along ventral margin to just before bulbous basal portion, this area about one-half width of median lobe, and forming sides of a shallow median trough along ventral surface of median lobe; parameres each with margins subparallel in lateral view, with a distinct slightly curved notch on inner margin just before apex in ventral view; internally with flagellum long, slender, with an angular bend about one-third distance from distal end, angle produced anterodorsally as a distinct "heel," flagellar guide-sclerite broad, asymmetrical.

Holotype male, Putnam, Illinois, Nov. 2, 1933 (Frison and Ross) at Lake Senachwine from ground cover on wooded banks in collection of Illinois Natural History Survey, Urbana, Ill. One topotypic paratype is in the author's collection. Other specimens were examined from Massachusetts, Illinois, Iowa, and North Carolina.

Eubaeocera charybda n. sp. closely resembles *E. scylla* n. sp. and *E. picea* (Casey) and is distinguished from those species in the respective discussions.

Eubaeocera deflexa (Casey), NEW COMBINATION

Baeocera deflexa Casey, 1893:515

Length 2.3-2.6 mm. Scutellum not visible; antenna as in Figure 4T. Aedeagus as in Figures 3B, 3C, 1.0 mm long, median lobe tapering to a rounded apex,

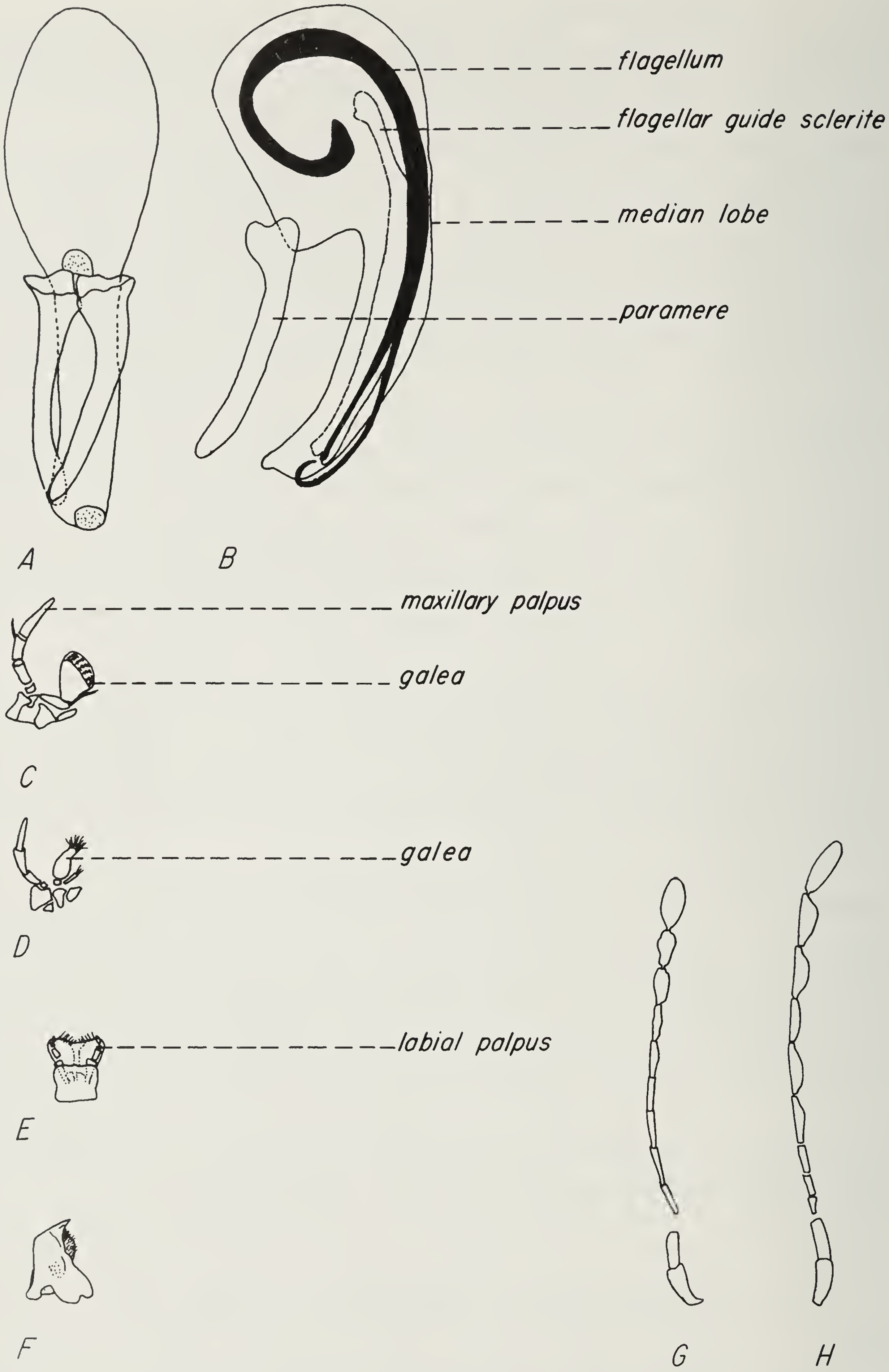


FIGURE 1. Nomenclature of aedeagus of *Eubaeocera* and comparison of mouth-parts and antenna of *Eubaeocera* and *Scaphisoma*. A—Ventral view of aedeagus of *Eubaeocera apicalis* (LeC.). B—Lateral view of aedeagus of *Eubaeocera apicalis* (LeC.). C—Maxilla of *Scaphisoma sp.*, ventral view. D—Maxilla of *Eubaeocera sp.*, ventral view. E—Labium of *Eubaeocera sp.*, ventral view. F—Mandible of *Eubaeocera sp.*, ventral view. G—Antenna of *Eubaeocera sp.* H—Antenna of *Scaphisoma sp.*

abruptly curved ventrad at apex; paramere strongly expanded just before base, narrowed at base and narrowing distally in lateral aspect, sinuous along inner and outer margins, with distinctive membranous flap at base on inner margin in ventral aspect; internally with flagellum long, narrow, a distinct angle at about midlength, bifurcating beyond this point as two very slender rami, flagellar guide-sclerite as in Figure 3C, somewhat variable in shape and size, but readily correlated with above figure.

The type in the T. L. Casey Collection at the U.S.N.M. was dissected by the writer. The type is from Boston Neck, Rhode Island; additional specimens have been examined from Massachusetts, New Hampshire, New Jersey, Pennsylvania, Virginia, North Carolina, Texas, and Colorado.

Eubaeocera deflexa (Casey) is distinctive among other species in its size range in having a distinctly angular flagellum, parameres that are rounded at the base in lateral aspect, and flap-like membranous lobes on the inner ventral margin of each paramere base.

Eubaeocera youngi Cornell, NEW SPECIES

Length 2.3-2.7 mm. Scutellum not visible; antenna as in Figure 4W. Aedeagus as in Figures 2M, 3L, 1.0 mm long, median lobe narrowing to a sharp point that is slightly bent ventrad at apex; parameres in lateral aspect thick, bending abruptly ventrad just before apex, in ventral aspect with outer margin gently curved, inner margin sinuate; internally with flagellum as in *E. congener* (Casey), flagellar guide-sclerite digitate, longer dorsal lobe with a slight protuberance on ventral margin, just before apex, other lobe shorter, unornamented.

Holotype male, Glenwood, Colorado, 15.5 (Hubbard and Schwarz), in the U.S.N.M. Other specimens examined from Ontario, Saskatchewan, Maine, Michigan, Wisconsin, Massachusetts, Indiana, New Jersey, West Virginia, and South Carolina (on a beach).

This is probably the species Erichson had at hand when he erected the genus *Baeocera* (his specimen is a female). It may be recognized by the characteristic bumb on the ventral margin of the flagellar guide-sclerite, and by the rather angular parameres in lateral aspect.

I am pleased to name this species for Dr. D. A. Young who was of considerable help to me throughout the study.

Eubaeocera congener (Casey), NEW COMBINATION

Baeocera congener Casey, 1893:515.
Baeocera speculifer Casey, 1893:515. (NEW SYNONYMY)

Length 1.8-2.0 mm. Scutellum not visible; antennae as in Figure 4U. Aedeagus as in Figures 2A, 3H, 0.70 mm long, median lobe tapering gradually to pointed apex; parameres extending beyond median lobe, broad, in ventral aspect sinuate on inner and outer margins; internally with flagellum of two intertwining sclerites that in lateral aspect resemble somewhat a broad, asymmetrical, skewed, reclining Arabic numeral "6," bifurcating for distal one-third or less; flagellar guide-sclerite shown in above figure by dashed lines, with characteristic notch in apex.

The type specimen of *congener,* in the T. L. Casey Collection at the U.S.N.M., was dissected by the writer. The type is from New York; additional specimens have been examined from Quebec, Manitoba, Saskatchewan, Massachusetts, Illinois, Indiana, Iowa, Nebraska, Kansas, District of Columbia, North Carolina, South Carolina, Georgia, Florida, Alabama, Louisiana, Arkansas, Texas, and New Mexico.

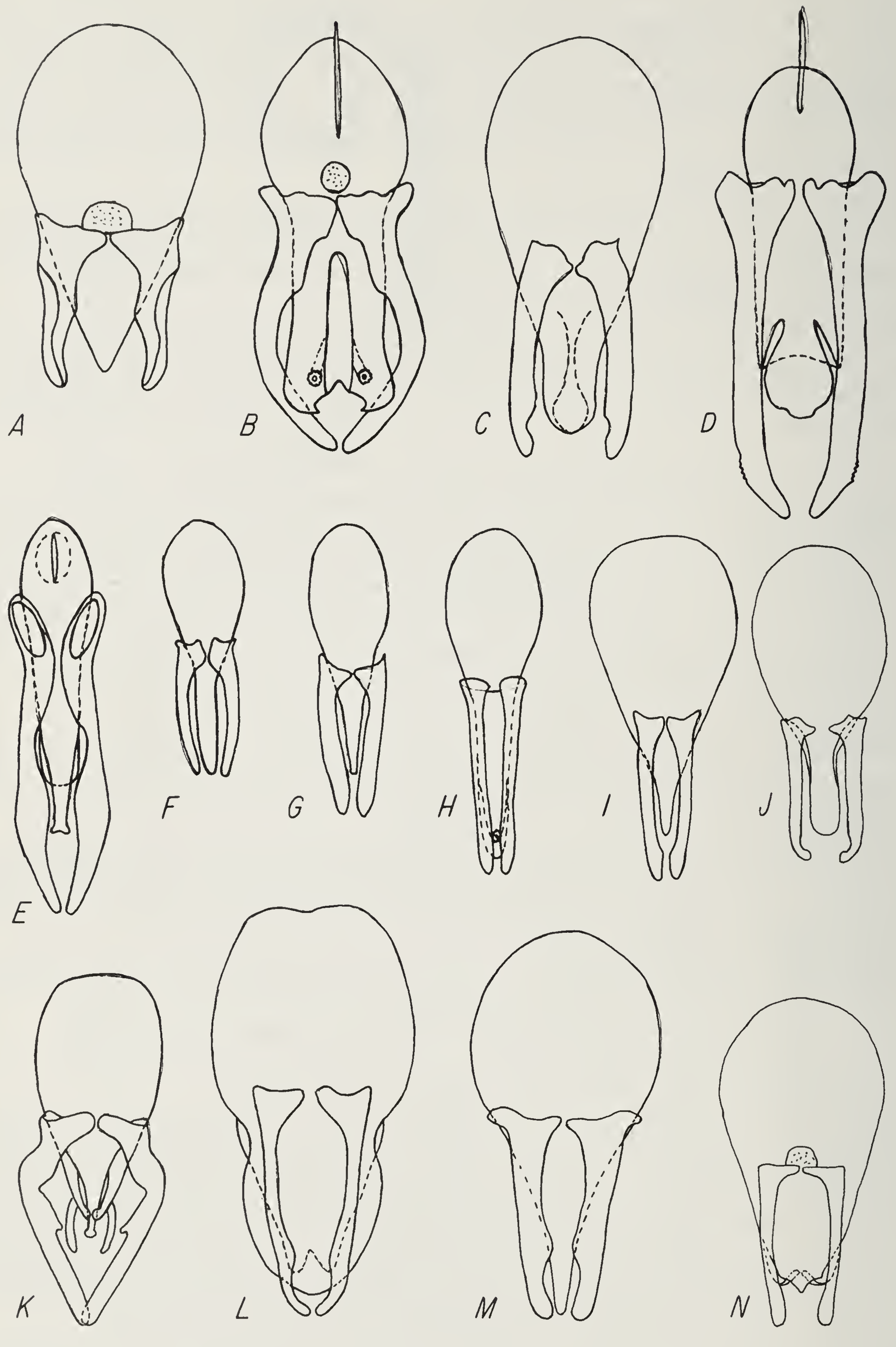


FIGURE 2. Ventral view of aedeagus of *Eubaeocera* spp. A—*congener*. B—*dybasi*. C—*scylla*. D—*kingsolveri*. E—*abdominalis*. F—*apicalis*. G—*eurydice*. H—*pallida*. I—*nana*. J—*charybda*. K—*mitchelli*. L—*picea*. M—*youngi*. N—*humeralis*.

Eubaeocera congener (Casey) is readily recognized by its large size, lack of scutellum, and typically notched flagellar guide-sclerite. It is most closely related to *E. cerbera,* from which it is distinct in the differently notched apex of the flagellar guide-sclerite.

Eubaeocera cerbera Cornell, NEW SPECIES

Length 1.7 mm. Scutellum absent; antenna as in Figure 4V. Aedeagus as in Figures 3E, 31, 0.63 mm long, with median lobe tapering gradually to apex; parameres extending well beyond tip of median lobe, thick, curved abruptly ventrad just beyond middle, in ventral aspect broad, sinuate along outer margin at base, more evenly curved along inner margin, rather densely punctuate at apex and along distal half of inner margin; internally with flagellum similar to *E. congener* (Casey), flagellar guide-sclerite with bifid, notched apex.

Holotype male, Davis Mountains, Jeff Davis County, Texas, 13 VII 1948, from oak-pinion-juniper litter, in the University of Arizona, Tucson, Arizona, and paratype, Santa Catalina Mountains, Arizona, 1-21-58 in the M.C.Z. Collected by Berlese funnel at 6,000 feet (C. W. O'Brien).

Eubaeocera cerbera n. sp. greatly resembles *E. congener* (Casey), but is readily recognized by the short, broad appearance of the aedeagus, and by the shape of the apex of the flagellar guide-sclerite, both of which characters differ from *E. congener.*

Eubaeocera securiforma Cornell, NEW SPECIES

Length 2.1 mm. Scutellum visible, large; antenna as in Figure 4X. Aedeagus as in Figures 3A, 3D, 0.94 mm long, median lobe tapering to a point; parameres each extending to just beyond apex of median lobe, broad, evenly curved along outer margin, sinuate along inner margin; internally with flagellum similar to *E. congener* (Casey), flagellar guide-sclerite with apex bent abruptly dorsad, securiform.

Holotype male, Marietta, Ohio, 10.11 (Hubbard and Schwarz), in U.S.N.M.

This species may later be included within the limits of *E. congener* (Casey), but it differs drastically in the shape of the apex of the flagellar guide-sclerite, and has a visible scutellum.

Eubaeocera humeralis (Fall), NEW COMBINATION

Baeocera humeralis Fall, 1910:116

Length 1.7-1.9 mm. Elytra at humeri and apices with poorly defined dull reddish maculae. Scutellum visible. Aedeagus as in Figures 2N, 4B, 0.60 mm long, median lobe broad, ventrally flattened, with a dorsal lip formed by the infolding of the ostial margin, the lip deeply punctate, ventral margin produced as a triangular median point; parameres each extending beyond median lobe, expanded slightly at apex; internally with a short, retort-shaped sclerite at ventral apex of median lobe, flagellum broad, asymmetrical, hammer-like at apex, flagellar guide-sclerite not apparent, internal sac present, in repose folded under and around flagellum, when extruded expanded as a subovate spheroid covered with short spike-like protuberances, the spikes more numerous dorsally and ventrally than medially.

The type (a female) is in the Henry Clinton Fall Collection at the M.C.Z. and was dissected by the writer. The type is from Tacoma, Washington; additional specimens were examined from British Columbia, Washington, New Mexico, and Arizona.

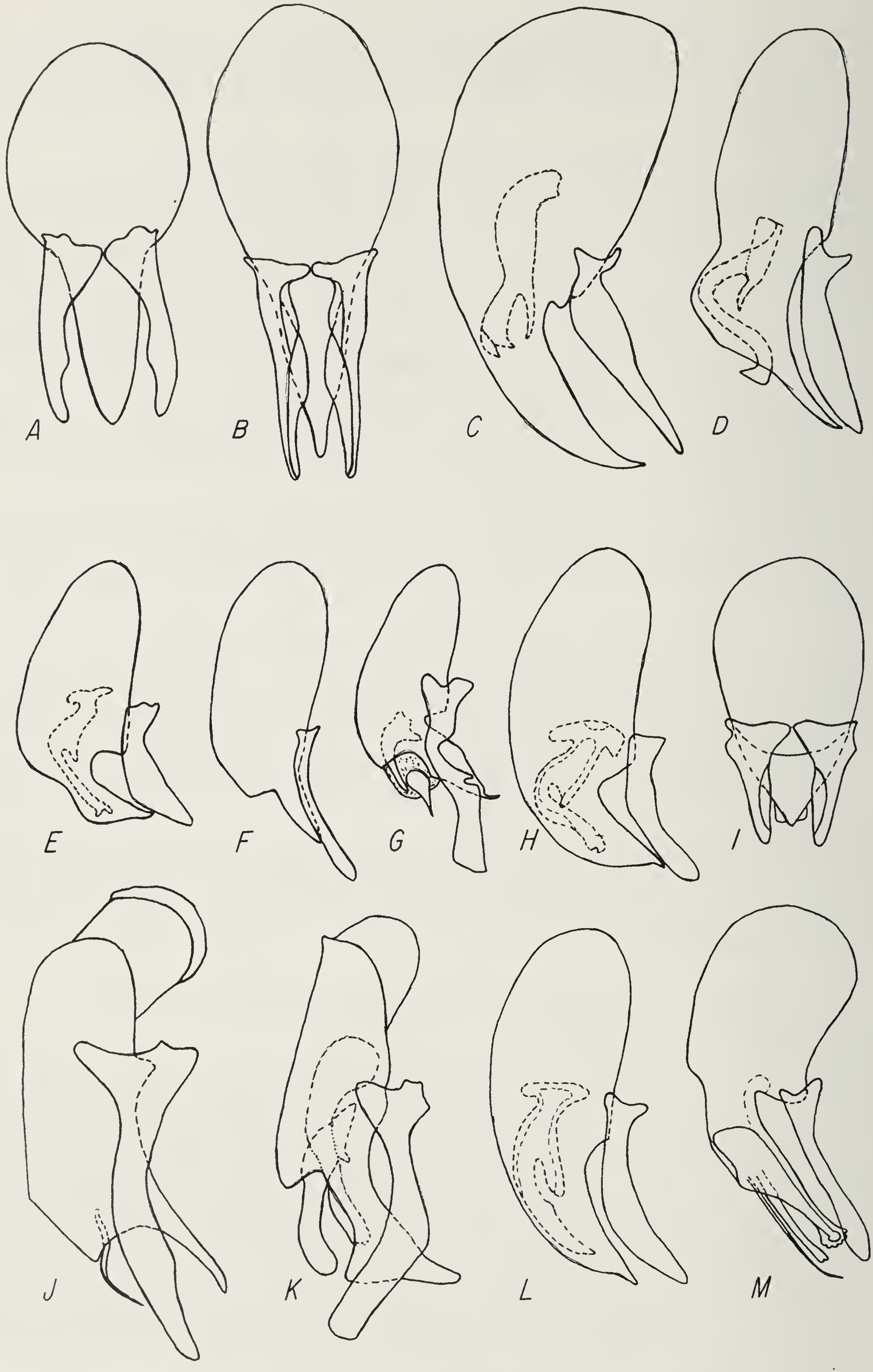


FIGURE 3. Ventral and lateral views of aedeagus of *Eubaeocera* spp. A—*securiforma*, ventral view. B—*deflexa*, ventral view, C—*deflexa*, lateral view. D—*securiforma*, lateral view. E—*cerbera*, lateral view. F—*nana*, lateral view. G—*mitchelli*, lateral view. H—*congener*, lateral view. I—*cerbera*, ventral view. J—*kingsolveri*, lateral view. K—*dybasi*, lateral view. L—*youngi*, lateral view. M—*pallida*, lateral view.

Eubaeocera mitchelli Cornell, NEW SPECIES

Length 1.2-1.4 mm. Scutellum visible, large; antenna as in Figure 4H. Aedeagus as in Figures 2K, 3G, 0.70 mm long, median lobe tapering abruptly to recurved subhamate apex; parameres each angulate, with tooth on inner margin just before middle, base very broad in ventral aspect; internally with flagellum short, scimitar-like posterior end trilobed, flagellar guide-sclerite large, with bulbous base tapering to fine point, internal sac small, sparsely decorated with short spikes, with a retort-like sclerite on sac below flagellum.

Holotype male, Holly Shelter Game Refuge, North Carolina, 24 Sept., 1964, from oak and pine logs and litter (J. F. Cornell and T. B. Mitchell). Type on indefinite loan to U. S. National Museum from N. C. State University. Paratypes as follows: two topotypic in N. C. State University and the author's collection, one Woodbury, N. J., 3.25, (H. W. Wenzel), in Ohio State University collection, two Westville, N. J., 1.22, in Ohio State University and J. F. Cornell Collections, one Florence, South Carolina, 25 Oct., 1962, (V. M. Kirk) in woods trash, in V. M. Kirk Collection, one N. C. Duplin County, 20 Sept., 1964, under pine logs (J. F. Cornell) in U. S. National Museum, one N. C. nr. Aberdeen, abandoned gravel pit, 8 Oct., 1964, (J. F. Cornell, T. B. Mitchell, B. S. Heming) moss with fungi, in California Academy of Sciences. Additional specimens seen, not paratypes, from New Jersey, North Carolina, and Florida.

E. mitchelli n. sp. is readily recognized by its angular, ornate parameres and several lobed median lobe.

I take pleasure in naming this species after Dr. T. B. Mitchell who kindly let me accompany him on several collecting trips that resulted in this and other species being collected.

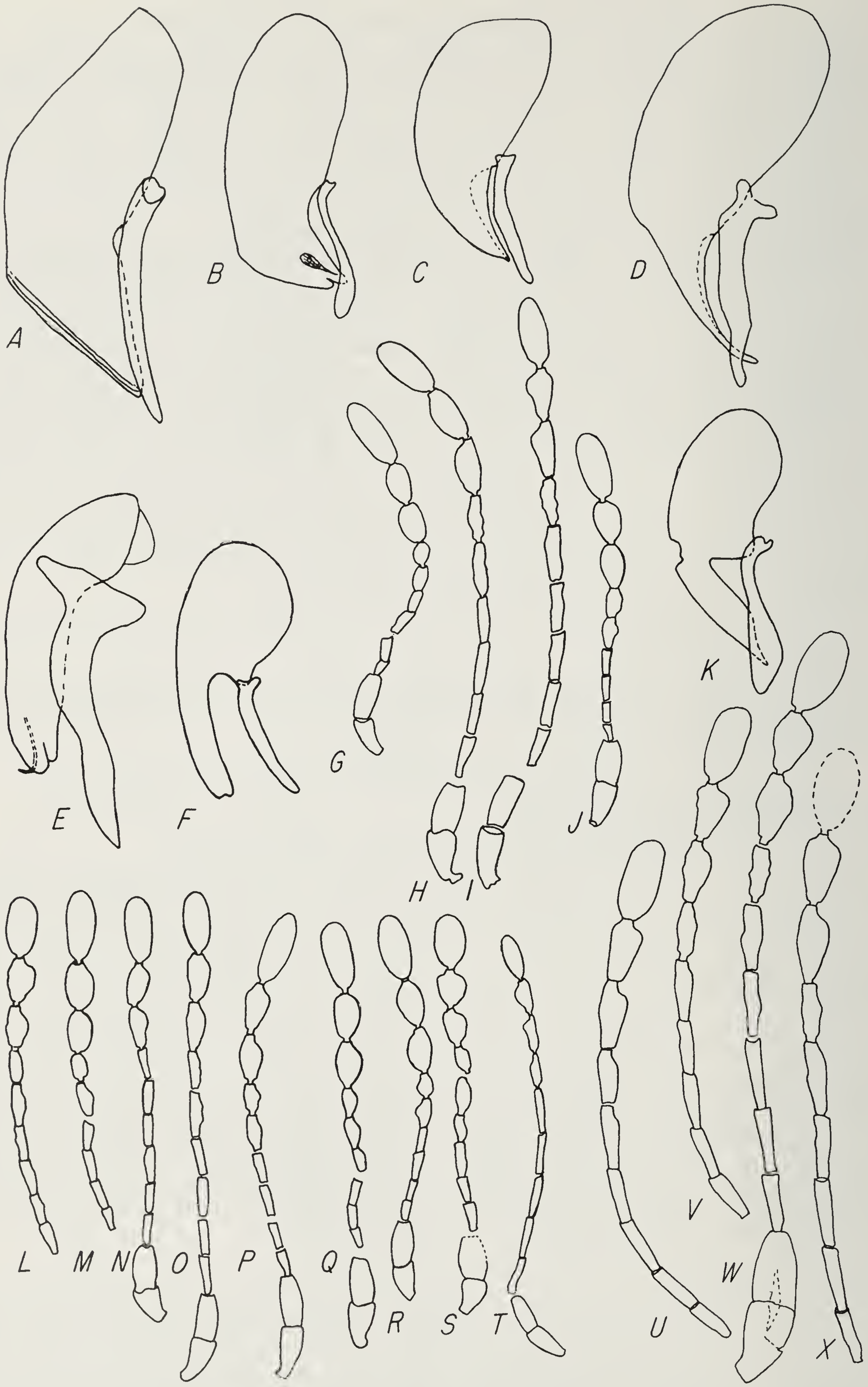
Eubaeocera nana (Casey), NEW COMBINATION

Baeocera nana Casey, 1893:516.
Baeocera rubriventris Casey, 1900:58. (NEW SYNONYMY)

Length 0.90-1.0 mm. Scutellum visible, distinct; antenna as in Figures 4R and 4Q. Aedeagus as in Figures 21, 3F, 0.25 mm long, median lobe tapering abruptly to a rounded point, sharply defined dorsally by almost right-angled bend in dorsal margin of lobe; parameres narrow, extending well beyond apex of median lobe, margins subparallel in ventral aspect, with slight flattened lobes on inner margin just before apex; internally with flagellum large, spirally, asymmetrically coiled, apex sharply curved dorsad, when everted with a faint internal undecorated sac visible ventrad to and anterior to flagellum, no flagellar guide-sclerite visible.

The type specimen of *nana* is in the T. L. Casey Collection at the U.S.N.M. and was dissected by the writer. The type is from Rhode Island; additional specimens have been examined from Massachusetts, New Jersey, Maryland, Illinois, Indiana, West Virginia, North Carolina, and South Carolina. Specimens from Plummer's Island, Md., were on *Stemonites fusca*.

FIGURE 4. Aedeagus and antenna of *Eubaeocera* spp. A—*picea,* aedeagus, lateral view. B—*humeralis,* aedeagus, lateral view. C—*charybda,* aedeagus, lateral view. D—*scylla,* aedeagus, lateral view. E—*abdominalis,* aedeagus, lateral view. F—*apicalis,* aedeagus, lateral view. G—*scylla,* antenna. H—*mitchelli,* antenna. I—*dybasi,* antenna. J—*picea,* antenna. K—*eurydice,* aedeagus, lateral view. L—*apicalis,* antenna. M—*pallida,* antenna. N—*abdominalis,* antenna. O—*kingsolveri,* antenna. P—*charybda,* antenna. Q—*nana,* antenna. R—*nana,* antenna. S—*eurydice,* antenna. T—*deflexa,* antenna. U—*congener,* antenna. V—*cerbera,* antenna. W—*youngi,* antenna. X—*securiforma,* antenna.



See page 15 for caption.

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OBSERVATIONS ON BEHAVIOR IN SCARITES (COLEOPTERA: CARABIDAE: SCARITINI)

By THOMAS F. HLAVAC[1,2]

INTRODUCTION

The genus *Scarites* Fabricius contains a large number of species of large, fossorial, pedunculate beetles and is found in all geographic regions, except the Australian. The number of species in America, north of Mexico, is open to question. Banninger (1938) recognizes 1 species and 7 subspecies while Ball (1960) states that 2 or 3 species may be present but concludes that this group "requires thorough study to determine the number of species present." For the northeastern United States 2 species have been recognized which differ mainly in size (Blatchley *1910): subterraneus* Fabricius 15 to 20 mm. long; and *substriatus* Haldemann, 25 to 30 mm. These forms are sympatric over much of their range with *subterraneus* reaching southern Canada (Lindroth 1961). Habitat differences, if any, are not known. Since these forms are sympatric with no apparent intergradation, they fulfill the definition of a biological species (Mayr, 1963, pp. 19-20) and should be regarded as specifically distinct.

The biology of the genus *Scarites* is poorly known. It is hoped that these observations will shed some light on the behavior and ecological morphology of this genus of carabid beetles.

BURROWING BEHAVIOR

The burrowing behavior of captive adult *Scarites subterraneus* Fab. and *substriatus* Hald. (Scaritini, Scaritina) was studied by placing adults on a damp sand substrate 5 inches deep in 21 x 7 x 6 inch plastic containers. The beginning of the burrow is invariably made against the side of the container, frequently in a corner. The mandibles are employed to loosen the substrate which is pushed to the side by the pro- and mesotibia. The head and pronotum are raised at intervals to pack loose material to the ceiling of the burrow. After substrate approximately equal to one body length has been loosened, the burrow is enlarged by an upward thrusting of the head and pronotum. If the substrate is not deep, the burrowing may be heard; a series of scraping scratching sounds, the work of the mandibles and protibia, followed by a dull crunching sound, the up-heaving. Of fifty burrow beginnings which I have observed, all but one followed the above pattern. In the sole exception the beetle began the entrance normally, but when the burrow was about one head length long, it began carting clumps of sand to the surface in the mandibles and depositing them on the surface around the entrance hole. As the burrow was lengthened, the loosened material was passed to the meta-legs and backed out to the surface. Frequently the beetle backed a load of sand out of the burrow, exited, and pushed aside the material accumulated at the burrow entrance. In five subsequent burrow beginnings this individual began in the normal manner, not bringing sand to the surface with the mandibles and metalegs.

The burrow is usually continued around the outer edge of the container next to the bottom. A few exit holes are made at this time. The burrow system is

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[2] I wish to gratefully acknowledge the help of Drs. Roland L. Fischer and William L. Downes for reading and criticizing the manuscript, Richard J. Snider for numerous helpful suggestions, and my wife, Barbara C. Hlavac, for preparing the illustrations.

enlarged by constructing branches toward the center of the container and numerous exit holes off the perimetal burrow. From the surface, the fully developed perimetal burrow appears as a large number of evenly spaced exit holes approximately one body length apart. No generalizations can be made about the pattern of internal burrow systems.

Both species of *Scarites* apparently spend the daylight hours motionless in the burrow. Specimens were repeatedly observed on the surface during the night. As soon as a light is turned on the beetle scurried about and entered a burrow. Food getting is one function of these nightly wanderings. In the few instances where prey-capture has been observed on the surface, the food item was seized by the mandibles; the beetle then began to back up in an apparently random manner until it backed into the first exit hole encountered. Feeding has never been observed on the surface. A specimen of *S. subterraneus* was once observed just inside the exit hole; it was offered a living dealated house fly placed 2 cm. in front of the beetle. As the fly began to beat about on its wing stubs, the beetle emerged, seized the fly and quickly backed into the burrow. Food placed in the burrow system was also eaten. In nature, these beetles burrow in mud and moist soil which is rich in soft-bodied insect larvae and annelids. It is possible that under these conditions most of the prey could be obtained from the burrow system. Because of the narrowness of the burrow, mating must take place on the surface.

Unlike most Carabids, death feigning is practiced in both *S. subterraneus* and *substriatus*. When handled roughly the beetle tucks in the legs and antennae, and rotates the pronotum upwards. The only motion made by the death feigning beetle is a slight twitching of the palpi. This comatose condition is maintained for very variable periods, sometimes up to 5 minutes. Specimens collected under logs and boards are almost always found in this state.

Intraspecific aggression, not common in carabids, is particularly well developed in these scaritines. Two specimens of any sex combination placed together begin almost invariably, upon contact, to bite each other on any part of the body with the mandibles. When a mandible is seized the attacker attempts to flip the other beetle on its dorsum with quick lateral jerks of the head and pronotum. This is normally countered by the "attacked" *Scarites* with a thrust of the pronotum and head in the opposite direction. If both beetles should exert a force in the same direction they tumble over and for an instant form an inverted V, the apex of this V being the united heads of the beetles and the basal point the elytral apices. No injuries have been inflicted in these combats, but several specimens which had been kept overnight in a large jar were dead and eaten out, the remaining live ones were lacking antennal segments and tarsi. All specimens were alive and complete when collected. In nature, this intraspecific aggressive behavior would tend to limit population density, and may indicate territorality.

MATING ACTIVITY

Four complete and several inconclusive matings of a single captive pair of *S. substriatus* collected in Saginaw and Wayne Counties, Michigan, were observed between June 1 and 15, 1965. These beetles were placed on damp sand substrate as previously described. Both immediately began to run about the surface staying near the perimeter much of the time. Upon meeting, the ♂ grasped the ♀ in its mandibles; the site of the preliminary bites depending upon the angle of interception. The ♀ reacted to this "attack" either by running off, with the ♂ following, or by turning about and facing the ♂ and biting his head and pronotum. In this head to head position, the ♂ quickly seized a mandible of the ♀, grasped it tightly and using it as a point of rotation, he swung about and mounted the ♀. The antennae of both beetles vibrated in a large arc while facing each other and while the mandibles were interlocked until mounting. Courtship behavior differs little from simple agressive behavior, between members of the same sex as described above. Mounting is quickly followed by intromission after which the ♂ released his hold on the ♀'s mandible and grasped her head just anterior to the eyes on the posterior lateral portion of the frontal plate. The beetles were, for the most part, motionless during copulation. Occasionally, however, the ♀ began to walk about, at which point the ♂'s hind legs which had been hanging free and not touching the ♀ began to "run" rapidly, lightly brushing the elytra and abdominal sternites of the ♀ who quickly ceased walking. Mating was terminated by the male withdrawing the aedeagus, releasing the ♀'s head and sliding off. On one occasion the ♂ approached the ♀ from behind. After biting the apex of her elytra once, he quickly mounted, grasped the ♀ in front of the eyes, and inserted the aedeagus. Matings, beginning at interception, lasted 5, 6, 7 and 8 minutes.

Alexander (1959) observed the mating of *Pasimachus punctulatus* Haldemann (Scaritini, Pasimachina) on July 9 in Hocking Co., Ohio, under natural conditions. Members of this subtribe do not burrow as do the Scaritina but run swiftly on the surface in search of prey.

The major differences between the mating behavior of *Scarites* and *Pasimachus* are found in the behavior of the ♂. The mandibles of ♂ *P. punctulatus* are considerably longer than the ♀'s. During courtship and copulation, these are used to grasp the female around the peduncle (the narrow anterior portion of the mesothorax). Alexander reports that prior to intromission the ♂ taps the ♀'s apical edge of the terminal abdominal sternite with his parameres for a period of 90 seconds. This paramere tapping has not been observed in *Scarites*.

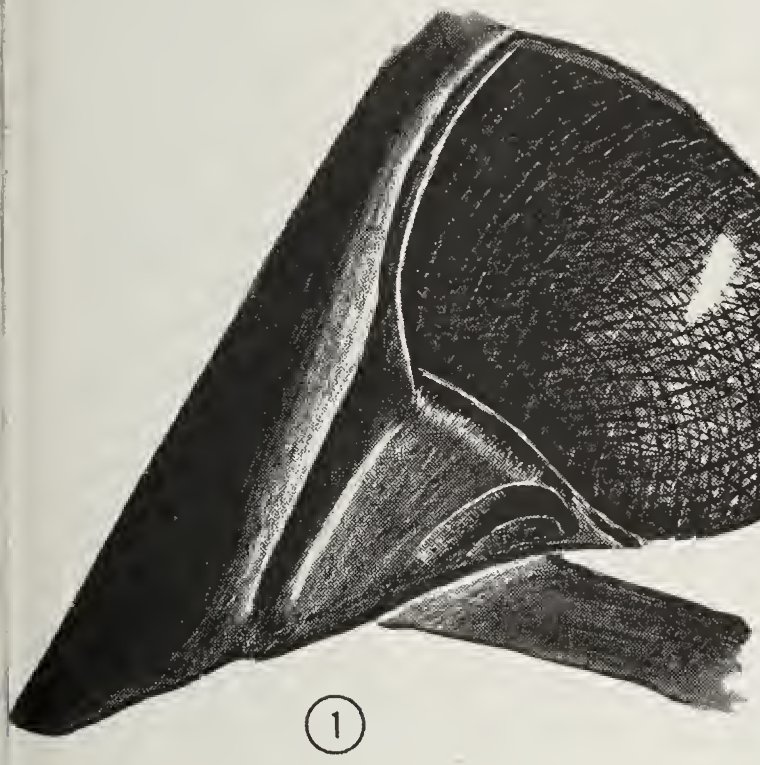
The posterior lateral portion of the frontal plate in *Scarites* differs considerably from that of *Pasimachus*. These structural differences are correlated with mating behavior. In *Scarites* this surface is flattened, slopes medially, and has a groove along the ventral margin and a definite dorsal ridge (fig. 1). In *Pasimachus* neither a dorsal ridge nor a ventral groove is present (fig. 2) and the surface curves gently, most of the surface area being in a vertical plane.

Larval Activity

Second and third instar larvae of *S. subterraneus* were observed in the laboratory under conditions similar to those described for adults. Five larvae were obtained from ♀'s in a manner which may give an insight into behavior under natural conditions. Three ♀'s collected June 18, 1965 in Barry County, Michigan, were confined in separate containers in a moist sand substrate. On July 1 the beetles were removed and plaster of Paris poured into the burrow system to obtain a cast. The next day a larva was observed against the side of the container in a burrow of its construction. In the next two days, 4 additional larvae were collected in the same manner. Three larvae were collected from 1 container and 1 each from 2 others. The sand employed was collected from a lake beach several months before in a very dry form and had been stored dry until moistened for use. It would seem reasonable to suppose that these larvae were the offspring of the captive ♀'s and that no macroscopic food was available to the larvae in the substrate. Each adult had been fed twice in the 13 days since capture; the food in both cases was dragged into the burrow system. A detailed search of the plaster cast failed to reveal any larval burrowings emanating from the adult burrows. These larvae presumably fed on insect pieces brought into the burrow by the adult. There would seem to be a possible relationship between the parent and larvae. It would be hasty, however, to make any definite statement on the basis of these few observations.

Larval burrows run parallel to the surface, then slope upward for a short distance and lead to a 45° angle opening at the surface. This latter portion is about equal to one body length of the larva. Specimens were frequently observed, in dim light, in the burrow with the long, slender mandibles extending above the surface. As a piece of dead insect was brushed against the mandible, the larvae rapidly seized it and dragged it below the surface and began to feed. If the item was too bulky to be brought into the burrow, the larva pulled as much in to the burrow as possible and fed on it from below. The larvae, like the adults, leave the burrow at night and wander about the surface of the substrate.

The second molt took place on July 7 in an enlarged bottom edge burrow. Fully colored adults left the pupal chamber in a corner of the container between August 18 and August 20.



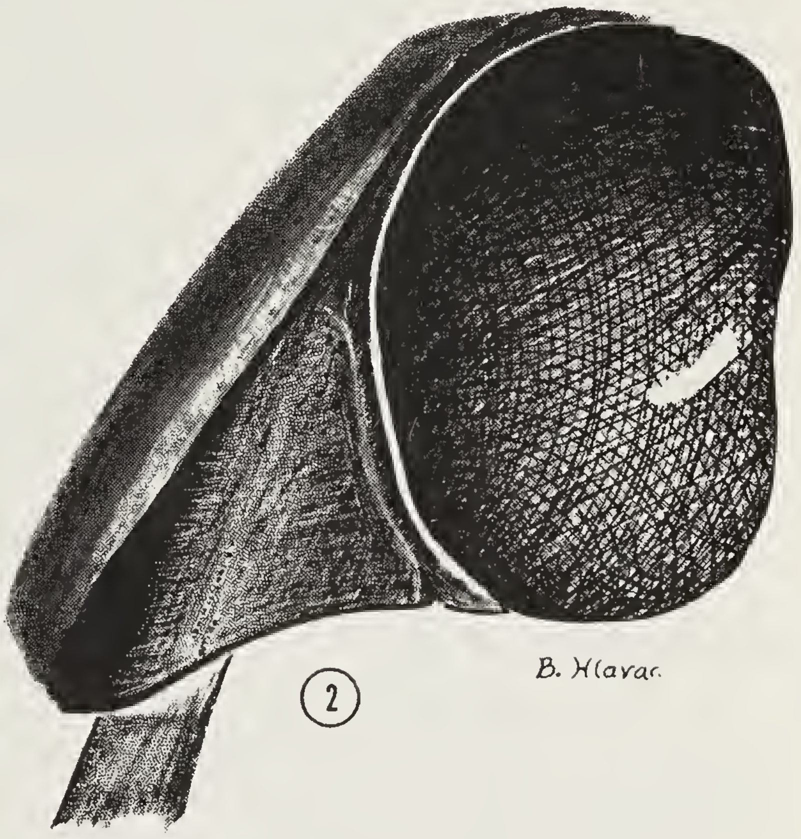


FIGURE 1 Lateral view of frontal plate of *Scarites subterraneus* Fab.
FIGURE 2 Same of *Pasimachus punctulatus* Hald.

DISCUSSION

Several morphological features of *Scarites* seem to be adaptations for a fossorial existence. The mandibles of scaritine carabids are typically large and conspicuous, are employed in "eating away" the head area of the burrow, in mating, and in seizing and chewing prey. The distal portion is slender, sharp and is used in seizing prey and burrowing. The proximal or molar area is employed in crushing and squeezing tissues out of the exoskeleton of insect prey (carabids rarely ingest large solid food particles). The amount of wear on the mandibles and on the body surface is considerable. The ratio: length of mandible/interocular distance, varied from .8 in teneral examples of *S. subterraneus* to .6 in well-worn, overwintered forms. The lateral portion of the vertex is modified in most scaritines to form a round plate covering the antennal insertion, protecting it from mechanical injury. The antennal scape is long and while burrowing is held at a right angle to the flagellum. This position is employed when the beetle is patrolling the burrow system and when seizing prey on the surface. When on the surface, the scape and flagellum are held in alignment and pointed forward at about a 45° angle to the long axis.

The broad digitate protibia and the strong setae on the lateral margin of the meso- and metatibia are employed in clearing the burrow of material loosened by mandibles and pronotum. The larvae also burrow with the legs and mandibles. The pro-legs are morphologically similar to the meso- and meta-legs. All 3 pairs have the trochanter femur, and tibia armed on the ventral surface with a large number of short, stout spines.

The pedunculate body form is found in many diverse taxa of burrowing insecta, i.e., Passalidae, Lucanidae *in partem* and Gryllotalpidae. A narrow pro-meso thorax articulation allows the pronotum to rotate through a wide angle dorsoventrally, which in *S. substriatus* is about 45°. While burrowing, the head and pronotum are frequently rotated upward and the head positioned so that the flat vertex is roughly parallel with the surface. Dorsoventral scraping of the head of the burrow with the mandibles is accomplished more through rotation of the prothorax than through the rotation of the head.

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APION LONGIROSTRE OLIVIER OCCURS ON COTTON IN THE UNITED STATES (COLEOPTERA: CURCULIONIDAE)

By D. G. Kissinger[1]

The distribution in North America of *Apion longirostre* Olivier, the "hollyhock weevil," has recently been treated by Warner (1964, Coleop. Bull. 18:17). There it was pointed out that the species is associated with cotton in Turkey. Recently a specimen was sent to the author for identification labeled, "Clay Co., Arkansas, 21 August 1964, D. Barnes, on cotton square." The species now occurs in the United States much further west than indicated by Warner; material has been seen from Denver, Colorado. W. E. Simonds, of the California Department of Agriculture, (in litt.) indicates the species has been found in the following California counties: Amador, El Dorado, Napa, Placer, Plumas, Sierra, Siskiyou, Sonoma, and Tuolumne.

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[1] This work was supported by National Science Foundation.—*Atlantic Union College, South Lancaster, Mass.*

NOTES ON THE BUPRESTIDAE (COLEOPTERA): PART V WITH DESCRIPTIONS OF PREVIOUSLY UNKNOWN SEXES

By G. H. Nelson[1]

This paper includes new distributional and biological information as well as descriptions of Buprestids previously known from only one sex. Thanks are due the late Dr. Harold Grant, Jr. for allowing the writer to examine types in the Academy of Natural Sciences of Philadelphia, to Mr. George Vogt for making comparisons with types in the U. S. National Museum and to Mr. D. S. Verity for allowing the writer to mention records from his collection.

Polycesta hageni Barr, 1949, American Mus. Novitates, No. 1432, pp. 30-32, fig. 9. This species is recorded from Kern and Inyo Cos., CALIF., One male and one female were cut from *Chrysothamnus nauseosus* (Pall.) Britt. by D. S. Verity at Summit Valley, San Bernardino Co., CALIF., May 30, 1965.

Acmaeodera adenostomensis Knull, 1941, Ann. Ent. Soc. America 34:691-692, fig. 4. Two specimens of this species were collected by E. L. Sleeper 4-10 mi. S. of San Matias Pass, Baja Calif. N., MEX. (first record for the state).

Acmaeodera alacris Horn, 1878, Trans. American Ent. Soc., 7:25, pl. 1, fig. 40. This species has long been considered one of the rarest of North American *Acmaeodera*. It was described from an unique specimen labelled as from Fort Yuma, CALIF. This species has not been collected in the United States since and some believe that the locality was in error. The writer collected a good series of both sexes 3 mi. W. of Tehuantepec, Oaxaca, MEX. July 9-Aug. 2, 1965. Most of the specimens were collected on *Cercidium plurifoliolatum* Micheli but a few were found on *Prosopis juliflora* (Sw.) D. C. The coloration varied from metallic green (as in the type) to bronzy-green and greenish-black. Some reduction of the yellow markings occurs in a few specimens but the markings appear relatively uniform in this series. The males vary in length from 6 to 10.6 mm., in width from 2.2 to 3.4 mm., while the females vary in length from 7.2 to 10.7 mm. and in width from 2.5 to 3.5 mm.

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Buprestis connexa Horn, 1875, Trans. American Ent. Soc., 5:148. In Helfer's 1941 revision of this genus *connexa* was recorded only as far south in California as Yosemite National Park. Before the writer are two specimens from Southern California, one from Big Pines, San Gabriel Mts., Los Angeles Co., July 27, 1962 and the other from the Santa Ana River Gorge, San Bernardino Mts., July 3, 1964, J. A. Robertson.

Poecilonota salicis Chamberlin, 1925, Pan-Pacific Ent., 1:186. One specimen was taken by E. L. Sleeper 13 mi. S. of San Matias Pass (first record for Baja Calif. N., MEX.).

Chrysobothris helferi Fisher, 1942, United States Dept. Agric. Misc. Publ., No. 470:92, 93, figs. 32 and 115c. Two males collected by E. L. Sleeper in Baja Calif. N., one 48 mi. S.E. of Ensenada and the other 13 mi. S. of San Matias Pass are first records for Baja Calif. N., MEX.

Chrysobothris chalcophoroides Horn, 1886, Trans. American Ent. Soc., 13:109, 110-111, pl. 6, figs. 203-206. This species was described from an unique female from "Arizona." At the time of his revision Fisher (1942) had only three female specimens for examination and the male was unknown. During the past several years the writer has taken 3 females and 4 males all on *Quercus arizonica* Sargent. One of the latter was compared with the female holotype in the Academy of Natural Sciences of Philadelphia and is described here.

Description of male.—Form as female but differs as follows: slightly less robust; last visible sternum (fig. 2) with triangular smooth area at base, apex deeply, arcuately emarginate, angles strongly produced and obliquely truncate; anterior tibia with elongate dilation at apex (fig. 4) and brush of stiff hairs on inner side of dilation.

Length: 20.0 mm. Width: 8.2 mm.

Genitalia (fig. 3).

Plesiallotype in the writer's collection from ARIZ., Santa Rita Mts., Madera Canyon, July 30, 1963, G. H. Nelson, on *Quercus Arizonica* Sargent.

The four males vary in size from 18.0 to 22.0 mm. in length and from 7.7 to 9.0 mm. in width; the three females from 21.0 to 22.0 mm. in length and from 8.7 to 9.5 mm. in width.

Chrysobothris wickhami Fisher, 1942, United States Dept. Agric. Misc. Publ. No. 470:209, 210, fig. 88. Three females were the only specimens before Fisher when he described this species. During the past several years a short series of both sexes has been collected in Imperial Co., CALIF., on *Prosopis juliflora* (Sw.) D. C. A male, which compared favorably with the type, is described here.

Description of male.—Differs from female as follows: less robust; last visible sternum (fig. 8) with midline shallowly concave (carinate in female) and apex deeply, arcuately emarginate, angles produced and obliquely truncate; anterior tibia with row of small teeth on inner margin and brush of stiff hairs near apex (fig. 6), middle tibia arcuate.

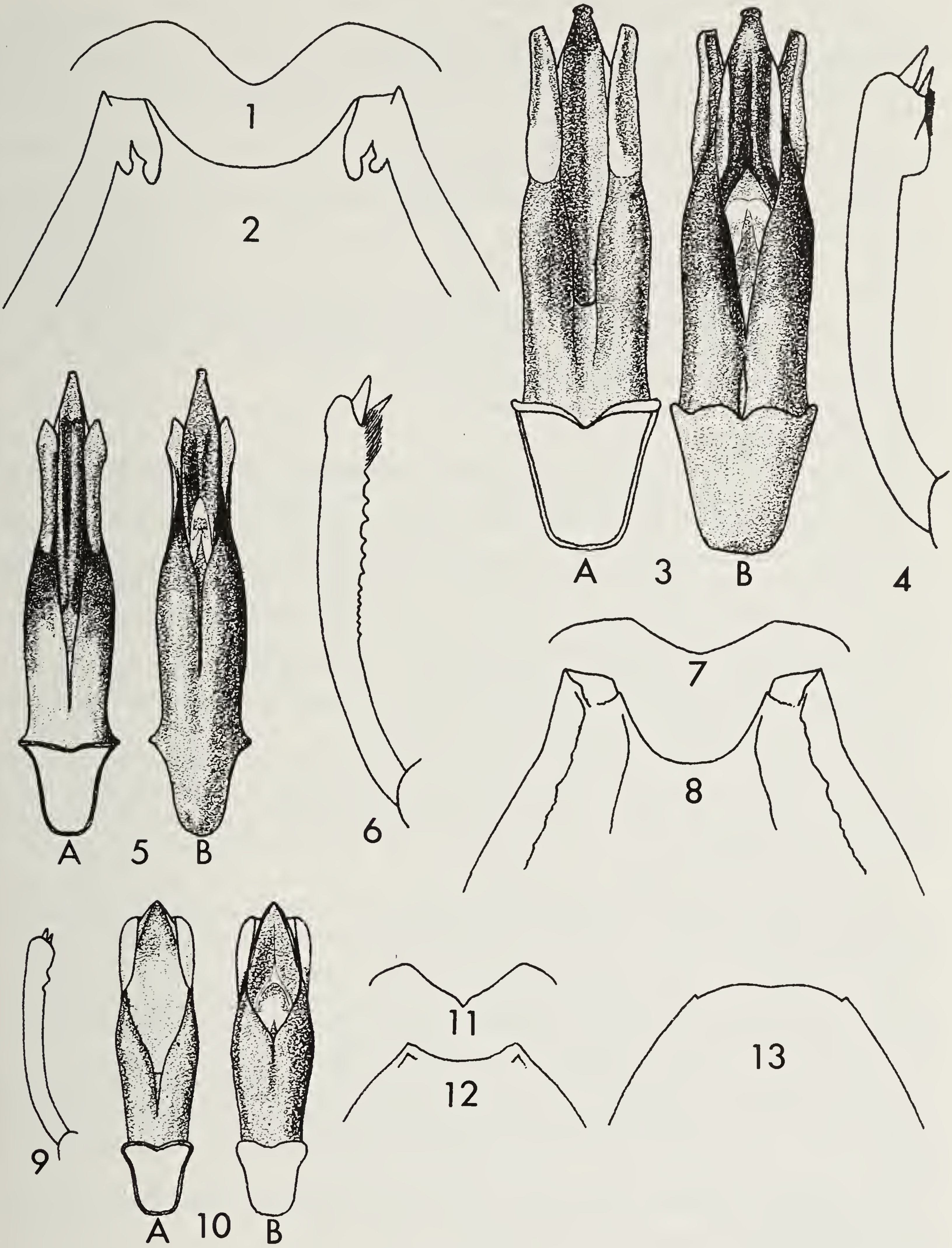
Length: 15.8 mm. Width: 6.2 mm.

Genitalia (fig. 5).

Plesiallotype in the writer's collection from CALIF., 8 mi. E. of Holtville, June 24, 1958, G. H. Nelson, collected on *Prosopis juliflora* (Sw.) D. C.

Two males are very similar including size; five females vary in length from 18.5 to 21.5 mm. and in width from 7 to 8 mm.

Chrysobothris prasina Horn, 1886, Trans. American Ent. Soc., 13:116, 118,



FIGURES 1-4, *Chrysobothris chalcophoroides* Horn (male); 1—clypeus; 2—last visible sternite; 3—male genitalia, A—dorsal view, B—ventral view; 4—protibia.

FIGURES 5-8, *Chrysobothris wickhami* Fisher (male); 5—male genitalia, A—dorsal view, B—ventral view; 6—protibia; 7—clypeus; 8—last visible sternite.

FIGURES 9-12, *Chrysobothris prasina* Horn (male); 9—protibia; 10—male genitalia, A—dorsal view, B—ventral view; 11—clypeus; 12—last visible sternite.

FIGURE 13, *Chrysobothris b. biramosa* (Fisher), last visible sternite, female.

pl. 7, figs. 244-247. This is another species described from a unique female. Specimens have been collected from the following localities: CALIF., San Diego Co., Riverside Co., San Bernardino Co., Los Angeles Co., Kern Co.; ARIZ., Coconino Co., Navajo Co. Two specimens from Palm Desert, Riverside Co. were collected on *Dalea spinosa* Gray and the rest were taken on *Ephedra.*

The male described here was compared with the female holotype in the Academy of Natural Sciences of Philadelphia.

Description of male.—Differs from female as follows: front of head golden green with cupreous tint and vertex with cupreous chevron; anterior pronotal angles cupreous; antennae golden-cupreous on basal two segments, darker cupreous distally; inner surface of profemora cupreous and outer surface of mesofemora with aeneous tint; protibia with small blunt tooth near apex (fig. 9), metatibia with row of small teeth on inner margin; last visible abdominal sternite shallowly, arcuately emarginate (fig. 12).

Length: 7 mm. Width: 2.75 mm.

Genitalia (fig. 10).

Plesiallotype in the writer's collection from CALIF., San Diego Co., 5 mi. E. of Jacumba, June 19, 1960, G. H. Nelson, on *Ephedra californica* S. Wats.

In the series at hand violaceous tints appear on the upper surface in some specimens of both sexes and an occasional specimen has an elongate postmedian violaceous to black spot on each elytron and this may be represented by two smaller spots. One male from near Winslow, ARIZ. has a violaceous pronotum and elytra that are blue with violaceous tints toward the apex.

Chrysobothris biramosa biramosa (Fisher), 1935, Proc. Ent. Soc. Washington 37:117-118. This species was described from an unique male. The female described here compared favorably with the type.

Description of female—Differs from male as follows: general form more robust; antennae serrate (not biramose), gradually narrowed toward apex, third segment about as long as next three segments combined; apex of last ventral sternum rounded (fig. 13).

Length: 11.5 mm. Width: 4.5 mm.

Plesiallotype, writer's collection from UTAH, Tooele Co., Skull Valley (type locality), July 16, 1962, G. H. Nelson and Family, collected on *Atriplex confertifolia* S. Wats.

The males vary in length from 7.5 to 10 mm., in width from 3 to 4 mm.; the females from 10 to 11:5 mm. in length, and from 4 to 4.5 mm. in width. For other notes on variation and distribution see Nelson (1966).

Agrilus obtusus Horn, 1891, Trans. American Ent. Soc., 18:288. This species has been known by only the male sex. A female that has been compared with the male type in the Academy of Natural Sciences of Philadelphia is made known here.

Description of female.—Slightly more robust than the male but otherwise alike externally.

Length: 9.5 mm. Width: 2:92 mm.

Female plesiallotype in the writer's collection from N. MEX., Whites City, July 19, 1959, D. G. Kissinger, on *Cassia sp.*

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MUTUALISTIC CLEANING BEHAVIOR IN AN AQUATIC BEETLE[1] (COLEOPTERA)

By GEORGE W. FOLKERTS

Interspecific relationships between animals in which one animal cleans the other, or removes parasites or excises injured or diseased portions from its body are known among various groups of organisms. Among vertebrates, often mentioned is the relationship between the African tick birds (*Buphagus* spp.) and numerous ungulates, notably the African buffaloes (*Syncerus* spp.) and certain rhinocerotes. Among the fishes, well known relationships exist between many of the smaller wrasses (Labridae) and a host of other marine organisms, the wrasses always being the cleaners.

In the invertebrate groups, many instances of mutualism are known, although few of these involve cleaner-client relationships. In the Crustacea, one or possibly several species of red or cleaner shrimps (*Hippolysmata* spp.) clean and service species of marine fishes, especially the morays (Muraenidae). In the insects, as far as the writer has been able to ascertain, there have been no definite relationships of this type noted. Some ornithologists have theorized that the anting behavior of birds, in which the birds pick up ants and place them among the feathers, is a relationship of this type. Supposedly, the insects crawl about among the feathers and kill or remove ectoparasites.

During a recent survey of the Hydradephaga of Alabama the writer had occasion to keep living specimens of several species of these aquatic beetles in captivity. One of these, a large dytiscid, *Cybister fimbriolatus* (Say), was placed in a 100 gallon aquarium for observation. Living with it in this tank was a large aquatic salamander, *Amphiuma means* (Garden), commonly called the congo eel. The amphibian had been in captivity for several years and had continually been plagued with a fungus which created lesions on the body and caused a two inch section of the tip of the tail to shrivel and become useless.

Several days after the beetle was introduced into the tank, it was noticed hovering in the vicinity of the salamander. Closer examination revealed that it was chewing on the fungus-ridden tail of the amphibian and feeding on the fungus and damaged flesh. The salamander remained motionless, resting on the bottom languidly, even though some apparently living tissue was being excised by the beetle. After about 20 minutes of this type of activity the beetle ceased feeding and swam slowly to the other end of the tank. Two days later the writer again noticed behavior of this type and it was evident that considerable quantities of fungus and tissue were being removed. Again the beetle ceased feeding after approximately 20 minutes. After a period of nine days, the beetle had entirely removed the diseased portion of the tail, a volume of material estimated at one and three-fourths cubic cms. Close examination of the stump showed no fungus present. The beetle then moved to the smaller, more shallow areas of infection on the animal's body and removed the fungus and necrotic tissue from two of these. Both were circular, about one cm in diameter and involved only the outermost layers of the skin. Seemingly, such activity would cause the salamander some discomfort, but in every case it remained inactive while the beetle fed.

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Cybister fimbriolatus is thought to be a predaceous beetle, feeding on small aquatic organisms of almost any type. In the situation just described, the aquarium contained many animals that were potentially food for the beetle. Among these were dragonfly nymphs, 14 fishes of six species (most less than one and one-half inches in length), two tadpoles, five newts, several small larval salamanders and numerous snails. At no time, as far as the writer could determine, did the coleopteran display any interest in any of these organisms.

Strict cleaner-client relationships are usually of such a nature that the client allows the cleaner to pursue its activities without molestation and remains motionless or almost so as the cleaner works. This seemed to be the case during these observations. When the writer touched infected areas with the finger or the end of a forceps, the amphibian either swam away or vibrated its body rapidly as if trying to shake off the offending object. No movements of this kind were noticed when the beetle was cleaning.

The foregoing observations are not indicative of a highly evolved cleaner-client relationship between these two species, but they do suggest that similar events may occur in nature. Other species of clients may be involved.

It is worthy of note that another smaller dytiscid, *Hydaticus bimarginatus* (Say), present in the tank, was never observed to engage in cleaning activities.

The writer wishes to thank Dr. Robert H. Mount and Dr. Hugh B. Cunningham for their critical reading of the manuscript and helpful comments.

ON THE NUMBER OF BEMBIDION SPECIES (COLEOPTERA, CARABIDAE) OCCURRING IN NORTH AMERICA

By Carl H. Lindroth

In a review of Part 3 of my "Ground-Beetles of Canada and Alaska" Arnett (1965) gave the total for genus *Bembidion* in North America, according to our present knowledge, as "about 411 species." This figure was apparently obtained by adding the reportedly 16 new species described in my book (actually, there are 21) to the "about 395" mentioned by Ball (1960, p. 113).

It should, however, be taken into account: (a) that a vast number of specific names in this genus, notably among those given by Casey, have been synonymized since Ball made his estimate, and (b) that several species originally described from the Old World have since been discovered in North America.

Bembidion is the largest genus of carabid beetles both in Eurasia and North America and it is of some interest to make a fair calculation of the number of species existing—or at least known. As far as America north of Mexico is concerned, I would like to do this against an historical background showing the main steps of advancement towards a more complete knowledge.

Leconte (1848) listed 42 species of *Bembidion,* but 7 of these must be regarded as synonyms of other names contained in the same paper. The correct number of species is thus 35.—In his later catalogue (1857), Leconte increased the number to 75 species (plus some uninterpretable names given by the old authors); 6 of these are now regarded as synonyms. The correct number is thus 69 species, twice as many as he treated less than 10 years previously.

The monograph by Hayward (1897) meant considerable progress. Besides 13 unrecognizable older names, he treated 124 species of *Bembidion (rickseckeri* Hayw. not counted, because it is now placed in a separate genus). Only 4 of Hayward's names are clear synonyms; the correct number of his species is therefore 120.

Casey (1918, 1924) described an immense number of new species among the *Bembidiini.* They were presented (in 1918) according to his customary fashion, that is, exclusively in the form of keys, into which also the already known species were inserted, as far as familiar to him. Some were, however, mentioned only in the accompanying text, under the pertinent group, and, in subg. *Odontium,* Casey gave only additions to Fall's previous revision (1910). The number of species of *Bembidion* treated in Casey's keys is therefore lower than what was actually recognized by him. Nevertheless (in 1918 and 1924 together), the imposing figure of 372 species was reached, 274 of which were described as new (subspecies not counted).

Leng incorporated the Casey names of 1918 in his Catalogue (1920) and those of 1924 in the First Supplement (1927), and also included several older names, not or incompletely treated by Casey. The Leng figures are 373 and 429 species, respectively. The Supplements II-V (1933-48) only raised the number by 4, to 433: 12 new species had been described during this period but, at the same time, 8 older names had been synonymized.

When Ball (1960) made his estimate, reliable at the time, of "about 395" North American species of *Bembidion*, he considered the new species added after 1948, mainly by Hatch (1950, 1953), and also the synonymizations made by Hatch (1953) and by myself (1954, 1955). However, most of the synonymy, chiefly of Casey names, was not established until in my "Ground-Beetles" (Part 3, 1963).

The correct number of species known from different periods since Leconte, 1848, is shown in Table 1.

Concerning the present estimate, the following three points should be stressed:

(1) The number of catalogue names, not (or not yet) synonymized, of species of genus *Bembidion* in North America is 305.

(2) This figure includes, however, 96 Casey names which have not been revised and of which the main part no doubt are pure synonyms. A rough estimate of how many may be assumed to remain valid, could perhaps be made as follows: Of the 178 Casey names within the genus revised by me (1963, etc.), 150 have been synonymized. The 28 valid ones—some of which entered "by the back door," that is, in replacement of an old preoccupied or otherwise inapplicable name—constitute 16(15.7)% of the investigated names. In the Table (bottom line) this proportion has been applied to the 96 still unrevised Casey names; 81 have been assumed to be synonyms and 15 to be valid. This brings the number of known North American species down to ca. 224.

(3) Now, several species of *Bembidion* presumably remain to be discovered, above all in the southwestern mountains. To make even a guess at what a group of skilled collectors could achieve there, and elsewhere, would be futile. If the necessary field-work is carried out before the end of the century and if, at the same time, the remaining Casey names have been revised, it seems likely that the number of known North American species of *Bembidion* will not substantially exceed 250.

TABLE 1

NORTH AMERICAN SPECIES OF BEMBIDION RECOGNIZED AT DIFFERENT PERIODS (APPROXIMATE FIGURES)[1]

	Listed	Synonyms	True Number
LeConte, 1948	42	7	35
LeConte, 1857	75	6	69
Hayward, 1897	124	4	120
Casey, 1918	> 324	119	<205
Leng, 1920	373	137	<236
Casey, 1924 (incl. 1918)	> 372	150	<222
Leng, Suppl. 1, 1927	429	183	<246
Leng, Suppl. 2-5, 1933-1948	433	187	<246
Ball, 1960	395	137	<258
Present state (incl. later additions by Lindroth, 1962-1964)	305	ca. 81[2]	ca. 224

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[1] Some of the figures, notably those referring to the Leng Catalogue, with supplements, are open to discussion. The use of incorrect or non-valid specific names sometimes prevent a definite interpretation.

[2] Supposed remaining undiscovered synonyms are counted as the equivalent of 84% of unrevised Casey species (see text).

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ACSIP

Rather than accimilate a lot of separate short notes and announcements, as in the past, I plan to write a continuous column under the above title. Hopefully, this will be worthwhile as a source of news of activities of some general interest, and of specific interest to those working on beetles.

Acknowledgements.- Beginning in 1962 (volume 16) through 1966, (volume 20) my good friend T. J. Spilman edited the BULLETIN. During these five years, one quarter of its life, the journal matured and became of age. Many significant papers were published, and many of the authors publishing in those volumes are among the world's most productive entomologists. The highest editorial standards were set and maintained by Spilman, standards that will be hard to equal. The former editor had the constant aid of the editorial board, but as usual, the real burden was carried by Spilman. We all wish it were possible for him to continue, but many miles now separate his office and the new editorial office of the BULLETIN. I know all of the Coleopterists who use the BULLETIN join with me in thanking Spilman and the old board for the good job they did.

The CUA Press carried on the business activities of the BULLETIN from 1959 (volume 13) through volume 20. They contributed substantially by furnishing office space and maintaining without cost, all of the publishing chores needed to run the journal. They still hold and will supply back issues through volume 20. This help contributed the first years of financial stability for the BULLETIN, for which are grateful. We are sorry that changing interests at Catholic University prohibited us from continuing this association and we thank the CUA Press for sending the BULLETIN on with us to PURDUE UNIVERSITY.

Finally, in the new home in the Mid-west, we have the sponsorship of a distinguished Department of Entomology, and the full cooperation of the PURDUE RESEARCH FOUNDATION. This top-level interest and approval is very encouraging for the future of the BULLETIN.

ACSIP.- The title under which this column appears refers to the project of which this BULLETIN is now a part. We hope to establish A Center for the Study of Insect Populations (ACSIP) with major emphasis on Coleoptera, where some of the suggestions made in a recent article in the Annals of the Entomological Society of America can be carried out. As these projects develop, they will be reported here.

Blatchley Collection.- Most readers are aware that the famous Blatchley collection of Coleoptera, Orthoptera, and Hemiptera is a major part of the Purdue Entomological Research Collection, now under the direction of this reporter. A full time curator is moving the remaining parts of the collection into drawers and trays, cataloging types, and preparing loans for interested revisors. Rapid expansion of the collection by the addition of new material (with emphasis on North American Coleoptera, Hymenoptera, and Odonata) threatens to make this collection one of major interest. We invite students to visit us - working space will be provided - and prompt attention will be given to all loan applications. At the present time there are four staff taxonomists associated with the collection: Dr. B. E. Montgomery (Odonata), Dr. Leland Chandler (Hymenoptera), Mr. J. N. L. Stibick (Coleoptera), and Dr. R. H. Arnett, Jr. (Coleoptera). In addition, Miss Janice Foster is a part time curator.

New BULLETIN format.- As you can see, there has been some change in the format of the BULLETIN. We have increased the page size so that we can use a new type face that will be compatible with typewritter composition and still give us as many words per line as before, using a more condensed type face. We end up with more lines and words per issue than before. By going to offset and using some typewritter composition, we hope to save enough to considerably enlarge the BULLETIN. One very great saving is in illustrations. Either line drawings or half-tone photographs can be used at no additional cost. There is no limit on the illustrations for articles now. We are also investigating the cost of color photographs. The current policy on composition is this: if the article is on insects, it will be set in linotype composition with justified right hand margins; if it is on literature, news, or notices, it will be set on the IBM typewriter. This composition costs nothing, and its use makes the job of editing much more flexible. Your comments and suggestions are invited.

Current literature.- One of the features of the BULLETIN that high printing costs forced us to discontinue a few years ago was the current literature section. As soon as possible, we will again cite current publications. Your help in sending reprints, announcements of publications, and reviews will be greatly appreciated. We may find it possible to increase the frequency of the BULLETIN to accommodate more literature listings.

Research notices.- Most subscribers have returned the forms indicating interests, exchanges, and similar information. This is being organized and will be included in an early issue.

Page cost charges.- Attention is drawn to the editorial policy on the cover, and to the fact that authors who have funds available for publication will be billed accordingly. This will help us increase the size of the BULLETIN. (To be continued.) - Ross H. Arnett, Jr.

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Any article, note, or news item likely to be of interest to readers of the BULLETIN will be considered. Articles with illustrations are particularly desired, and in all cases, descriptions of new species must be illustrated. Descriptions of new species or genera MUST contain keys or be correlated with existing keys.

NOTICES

SCOLYTIDAE: A taxonomic monograph of North and Central American Scolytidae is in preparation. Loans of specimens from these areas are desired. Please write before shipping material. Stephen L. Wood, Department of Zoology and Entomology, Brigham Young University, Provo, Utah 84601.

CARABIDAE: Revising Schizogenius of North America including Mexico. Desire material on loan or exchange. I am planning a generic study of the Scaritini of the world. D. R. Whitehead, Department of Entomology, University of Alberta, Edmonton, Alberta, Canada.

HYDROPHILIDAE: I would like to borrow specimens of Central and South American Paracymus for a study of this genus currently in progress. Dr. David P. Wooldridge, Southern Illinois University, Edwardsville, Illinois 62025.

SCARABAEIDAE and SCAPHIDIIDAE: Currently I am working on a revision of the scarab genus Dichelonyx with Dr. P. O. Ritcher. I am also doing a revision of the Scaphidiidae genus Toxidium. J. F. Cornell, Department of Entomology, Oregon State University, Corvallis, Oregon 97331.

CARABIDAE: Revision of Brachinus (including Pheropsophus) of North America and Mexico, and a reclassification of the Brachine genera of the world. Terry L. Erwin, Department of Entomology, University of Alberta, Edmonton, Alberta, Canada.

SCARABAEIDAE: Polyphylla Harris in America, North of Mexico. Part I: the diffracta complex, in press. Part II, the occidentalis, decimlineata, and hammondi complexes now being revised. Loan of specimens from Kentucky, Alabama, and Mississippi needed. Ronald M. Young, Department of Entomology, Purdue University, Lafayette, Indiana 47907.

ILLUSTRATIONS: Entomological illustrations done by full time, free-lance professional. All orders, stages, and morphological aspects illustrated. Wild M5 Stereo and Kyowa KO Monocular utilized. Rates arranged on per plate or per drawing basis. Portfolio remitted upon request. Kenneth E. Weisman, Forest Lake Road, Land O' Lakes, Wisconsin 54540.

SCARABAEIDAE: For exchange, Goliaths from Africa; especially desire large beetles from South America. Monguillon Michel, 7, rue Berryer, Paris 8, France.

OEDEMERIDAE: World revision now being completed; desire material for identification from all parts of the world. R. H. Arnett, Jr., Department of Entomology, Purdue University, Lafayette, Indiana 47907.

DRYOPOIDEA: I am interested in obtaining specimens or information concerning parasites (especially Hymenoptera) of aquatic and semi-aquatic beetles, particularly dryopoids. I should also like to obtain specimens of far western dryopoids, especially psephenids and elmids. Prof. Harley P. Brown, Zoology Department, University of Oklahoma, Norman, Oklahoma 73069.

CARABIDAE: Taxonomy, evolution, and ecology of North American Trechini, especially cavernicolous species. Thomas C. Barr, Jr., Department of Zoology, University of Kentucky, Lexington, Kentucky 40506.

TENEBRIONIDAE: Currently working on Neotropical Diaperini and Zopherini, revision of the genus Apsida, North American Talanus, and North American Tenebrionidae in general. Charles A. Triplehorn, Department of Entomology and Zoology, The Ohio State University, Columbus, Ohio 43210.

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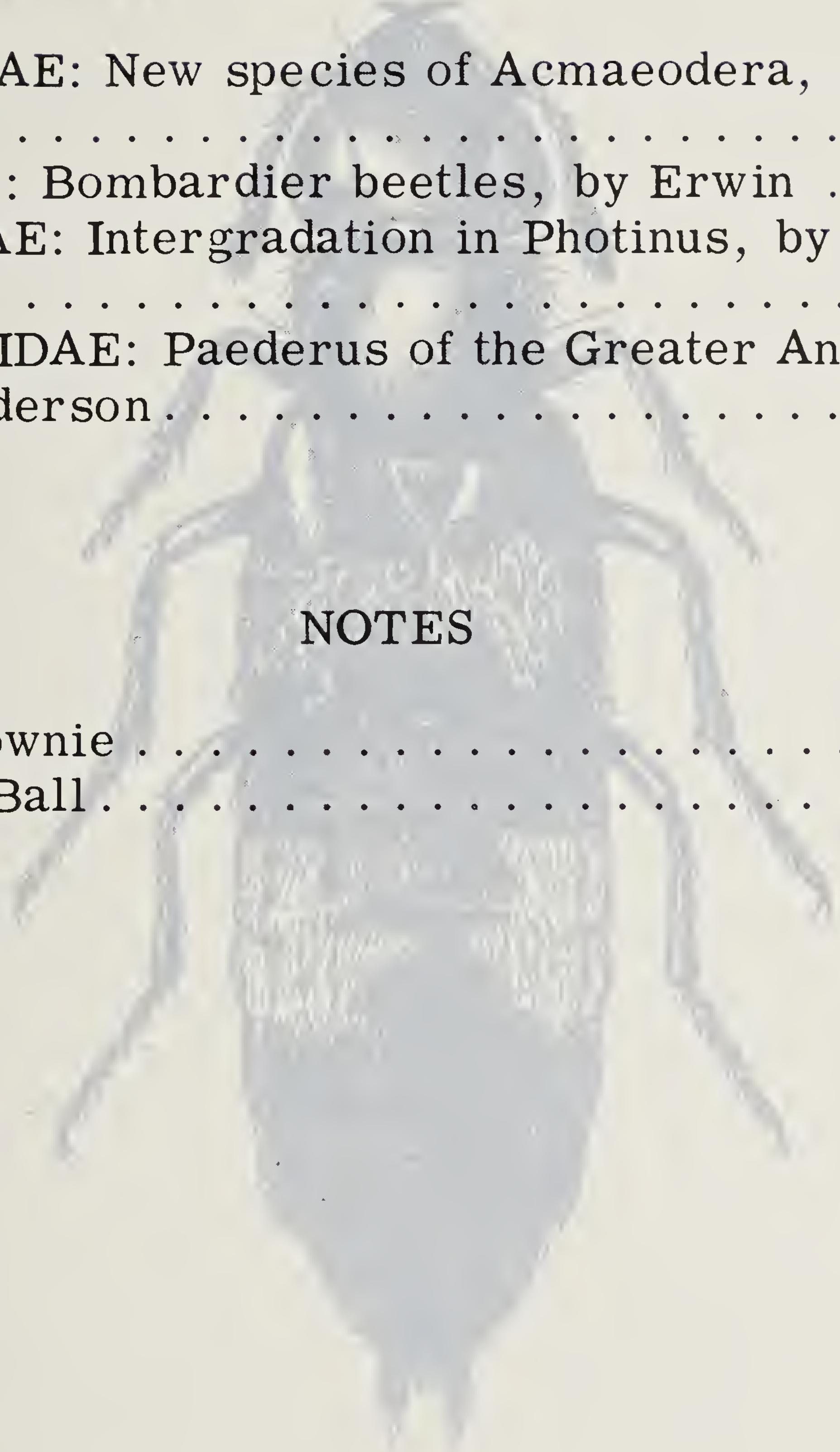
COLEOPTERISTS' BULLETIN



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VOLUME 21 JUNE 1967 NUMBER 2

DEPARTMENT of ENTOMOLOGY
Purdue University – Lafayette, Indiana

THE COLEOPTERISTS' BULLETIN

Founded 1947 by Ross H. Arnett, Jr.

The Coleopterists' Bulletin is published by the Department of Entomology, Purdue University, Lafayette, Indiana 47907 as a part of the projects of ACSIP, and is edited by Dr. N. M. Downie. It is issued four times a year beginning with March. All business matters as well as editorial matters and manuscripts may be sent to the above address.

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THE COLEOPTERISTS' BULLETIN

VOLUME 21 JUNE 1967 NO. 2

THE PRAIRIE PENINSULA AND SECONDARY INTERGRADATION IN PHOTINUS FIREFLIES (COLEOPTERA: LAMPYRIDAE)[1,2]

By JAMES E. LLOYD[3]

The literature dealing with organisms having distributions that extend from the plains states in a north-easterly direction to the Lower Great Lakes is extensive (see Transeau, 1935; Schmidt, 1938; Thomas, 1951; Thomas and Alexander, 1962). Studies of these organisms and investigations dealing with palynology, and glacial geology, have led to the conclusion that during a warm, dry (Xerothermic) period following the Wisconsin glaciation many western species extended their ranges eastward through a prairie extension. The range of the firefly *Photinus curtatus* Green suggests such a history. This case is of special interest since *curtatus* intergrades extensively in central New York State with a firefly of apparent eastern origin (Fig. 1)

The flashed mating signals and time of mating activity of the two forms are similar (Lloyd, 1966). They can be separated only by male genitalia (Green, 1956). Green named specimens having the lateral aedeagal lobes shaped like mittens, with thumblike dorsal branches, *P. curtatus* (Fig. 2). He considered those having hook-like lateral lobes, and attenuated dorsal branches and median lobes, to be *P. marginellus* LeConte (Fig. 2). None of the specimens seen by Green during his study were intergrades (personal communication), and the eastern limit of *curtatus* given by him was near Buffalo, New York. I have found virtually every degree of genitalic intermediacy between *curtatus* and *marginellus* in the Mohawk Valley of New York between Buffalo and Albany.

Figure 3 shows the genitalia of specimens of *marginellus* and *curtatus* that were collected outside the zone of overlap. Figure 4 shows the genitalia of intermediates that were collected in the Mohawk Valley. A simple "hybrid" index (Fig. 2) facilitates comparison. Index values for *marginellus* range between 0.6 and 1.0, for *curtatus* between 0.2 and 0.4 (Fig. 3) and for intergrades between 0.4 and 0.7 (Fig. 4).

I made extensive field collections and observations in New York, and examined several hundred specimens both from my own and museum collections. The following points are noted:

1. The only museum collection with obvious intergrades was the Albany collection (not seen by Green). Both intergrades and *curtatus* were present in Albany County in 1894 (Fig. 5). *P. marginellus* specimens from Albany County are dated 1902-1927 (Fig. 5).
2. Only five "possible intergrades" were found in collections from localities outside of New York State (Fig. 5).

---

[1] This investigation was supported by U. S. Public Health Service Predoctoral Fellowship No. 1-F1-GM-22, 196-01, the Sigma Xi-RESA research fund, and the Bache Fund, Grant No. 481.

[2] This paper was extracted from Appendix I of a thesis presented to the graduate school of Cornell University for the Ph.D. degree.

[3] Present address, Department of Entomology, University of Florida, Gainesville, Florida.

3. In 1963 I collected specimens in the Mohawk Valley in Madison, Oneida, Herkimer, Fulton, and Montgomery Counties. They occurred along the roadsides, in hayfields, over lawns, and at forest edges in great abundance. Index values for these specimens ranged from 0.25 to 0.70 (the range for intergrades). Two *marginellus* specimens were found in the Mohawk Valley in Cayuga County (0.79, 0.80).

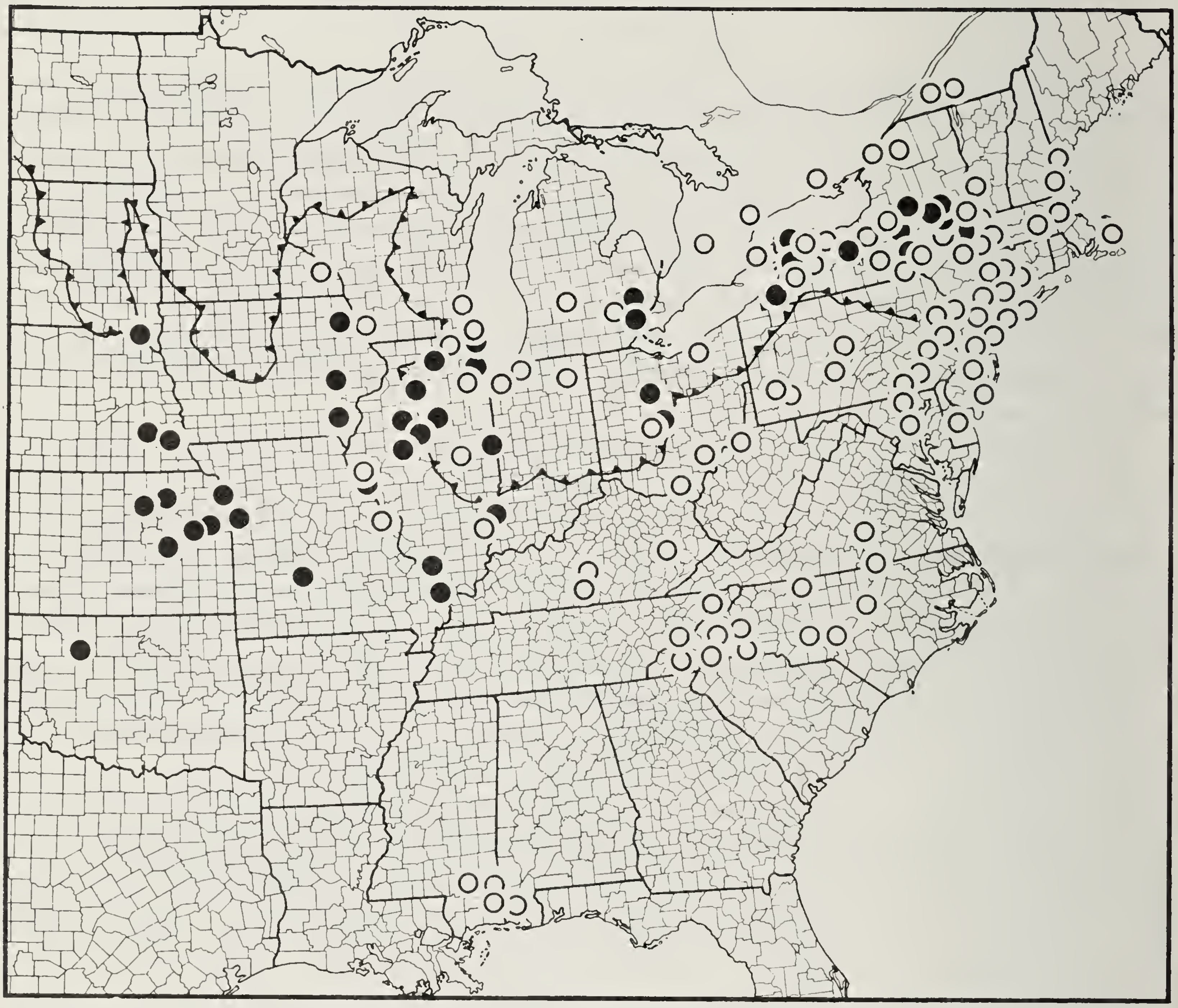

FIGURE 1. Dots = *curtatus*. Circles = *marginellus*. Toothed line = limit of Wisconsin Glacier.

4. Collections made in central New York from Oneida Lake in the Mohawk Valley southward over the hills and into the Chenango River Valley, southward along the Chenango River Valley, and along the highways that climb out of the Chenango Valley into the hills to the east and west revealed the following:

(a) From Oneida Lake southward the mean index for samples changed from 0.54 to 0.24 over a distance of about 30 miles; 20 miles further south it was 0.25 (Fig. 6).

(b) At Greene, Chenango County (about 55 miles south of Oneida Lake), the trend had reversed and the mean index value was 0.30 (Fig. 6).

(c) About 6 miles south of Greene mean index values for demes at the edge of the valley reached high *(marginellus)* levels; the indices for demes on the riverbank did not reach these same levels for 2 more miles (Fig. 6).

(d) All demes sampled along the highways in the hills to either side of the valley had high *(marginellus)* indices ($\bar{x} = 0.76$; Fig. 6).

DISCUSSION

Hypotheses based on the data thus far assembled must be tentative. Many more samples must be made and additional observations on behavior and ecology are necessary. The following, based on present data, are suggested:

1. The Wisconsin Glacier separated an ancestral population into eastern and western components.

2. During separation these populations diverged; the western population adapted to a warm, dry climate, and the eastern population to a damp, cool climate.

3. Following retreat of the glacier the western population expanded its range eastward along the prairie peninsula, and the eastern population expanded westward over the Appalachian and Adirondack Mountains, and into the Mohawk Valley.

4. The two forms met in the Mohawk Valley (perhaps ecological conditions are somewhat intermediate there), and both forms continue to enter the area; *curtatus* from the west, and *marginellus* from the neighboring mountains.

5. *P. curtatus* is ecologically favored in the hills of southern Madison County, New York, since the region has been extensively altered by agriculture. *P. curtatus* is not favored in Chenango County, New York, because great forest areas remain.

6. The agriculturalized Chenango Valley offers an avenue for continued range expansion in *curtatus,* and the attenuated vanguard of *curtatus* within the valley is a result of continuing southward movement.

I do not believe *curtatus* merits specific rank; a formal change in taxonomy will, however, be deferred until additional observations have been made.

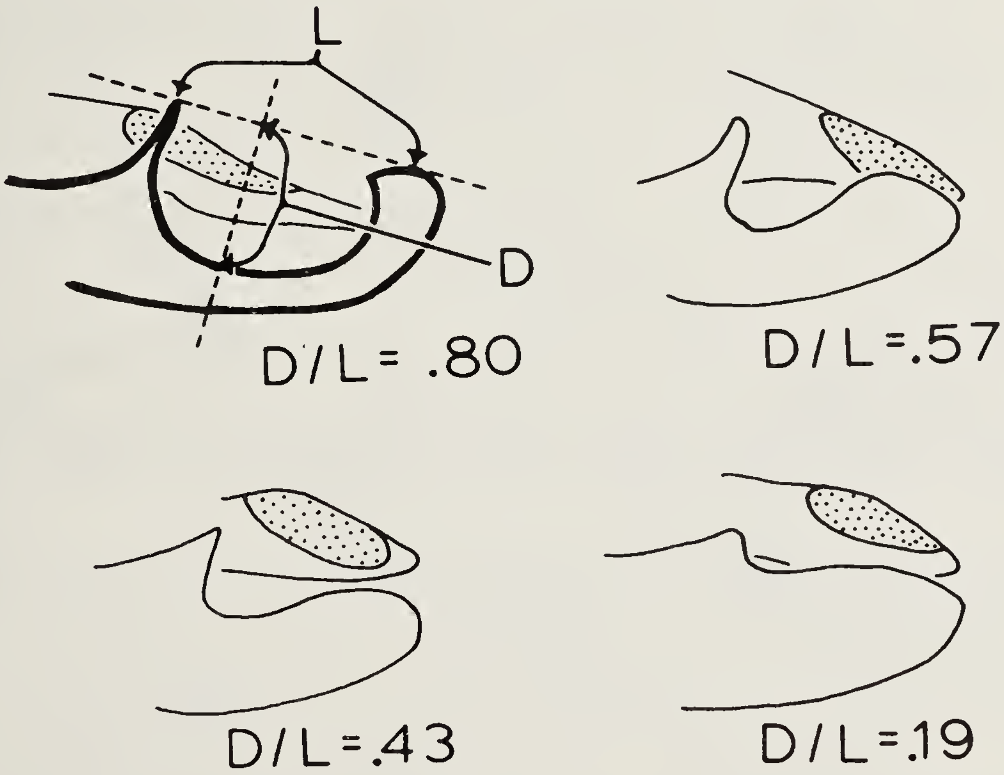

FIGURE 2. Right paramere and median lobe of the two forms and intergrades. *marginellus* = 0.80; intergrades = 0.43 and 0.57; *curtatus* = 0.19. Method of calculating index is shown at upper left.

ACKNOWLEDGMENTS

I thank the curators of the numerous museums that kindly loaned me specimens. Mr. Donald A. Pafka assisted extensively in the collection of specimens along the sampling transect. Dr. Thomas Eisner of Cornell University assisted in obtaining financial support. Dr. Richard D. Alexander and Dr. T. H. Hubbell of

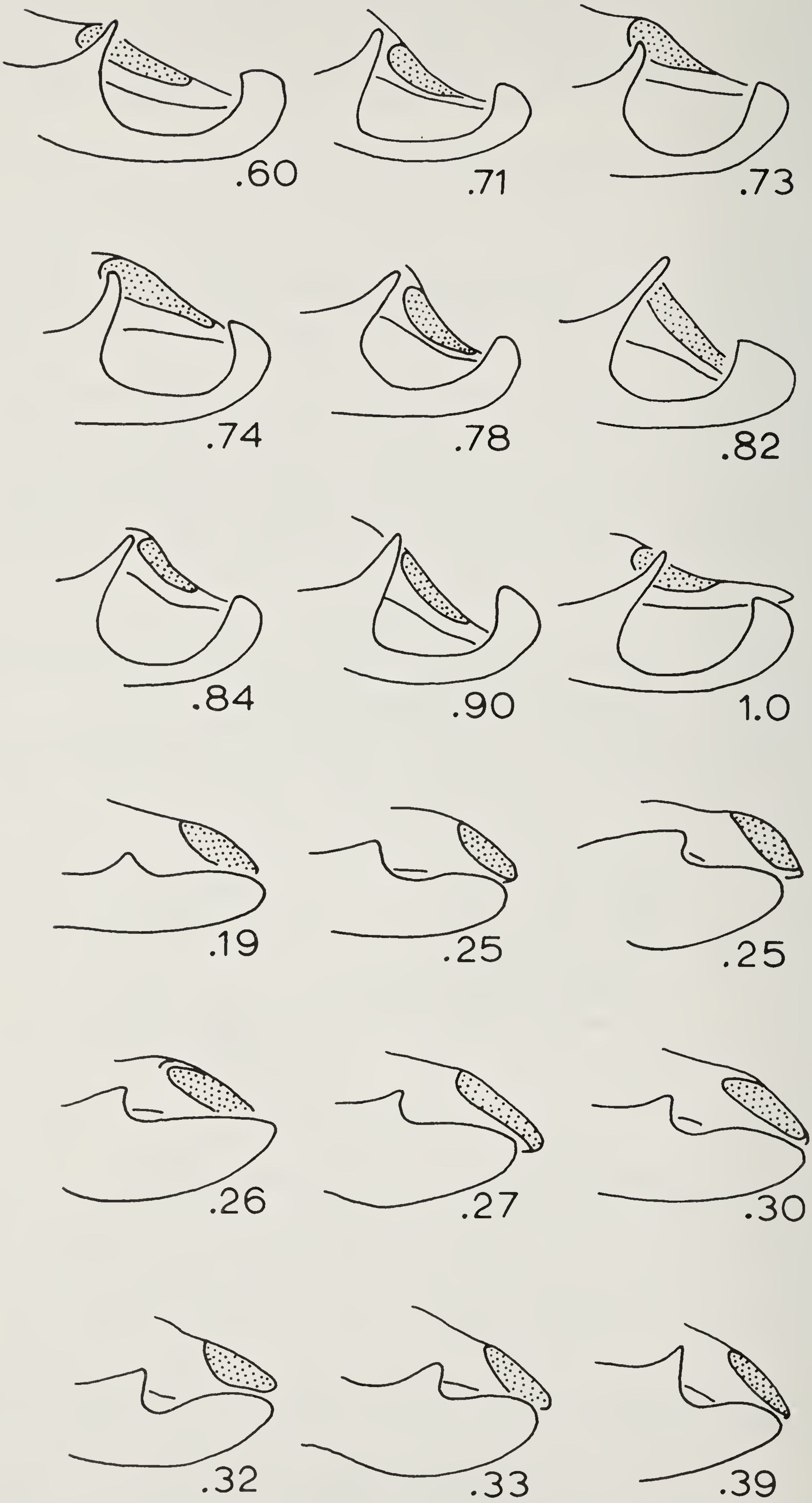

FIGURE 3. Upper nine (.60-1.0) right paramere and median lobe of *marginellus* collected outside zone of sympatry. Lower nine (.19-.39) right paramere and median lobe of *curtatus* collected outside zone of sympatry.

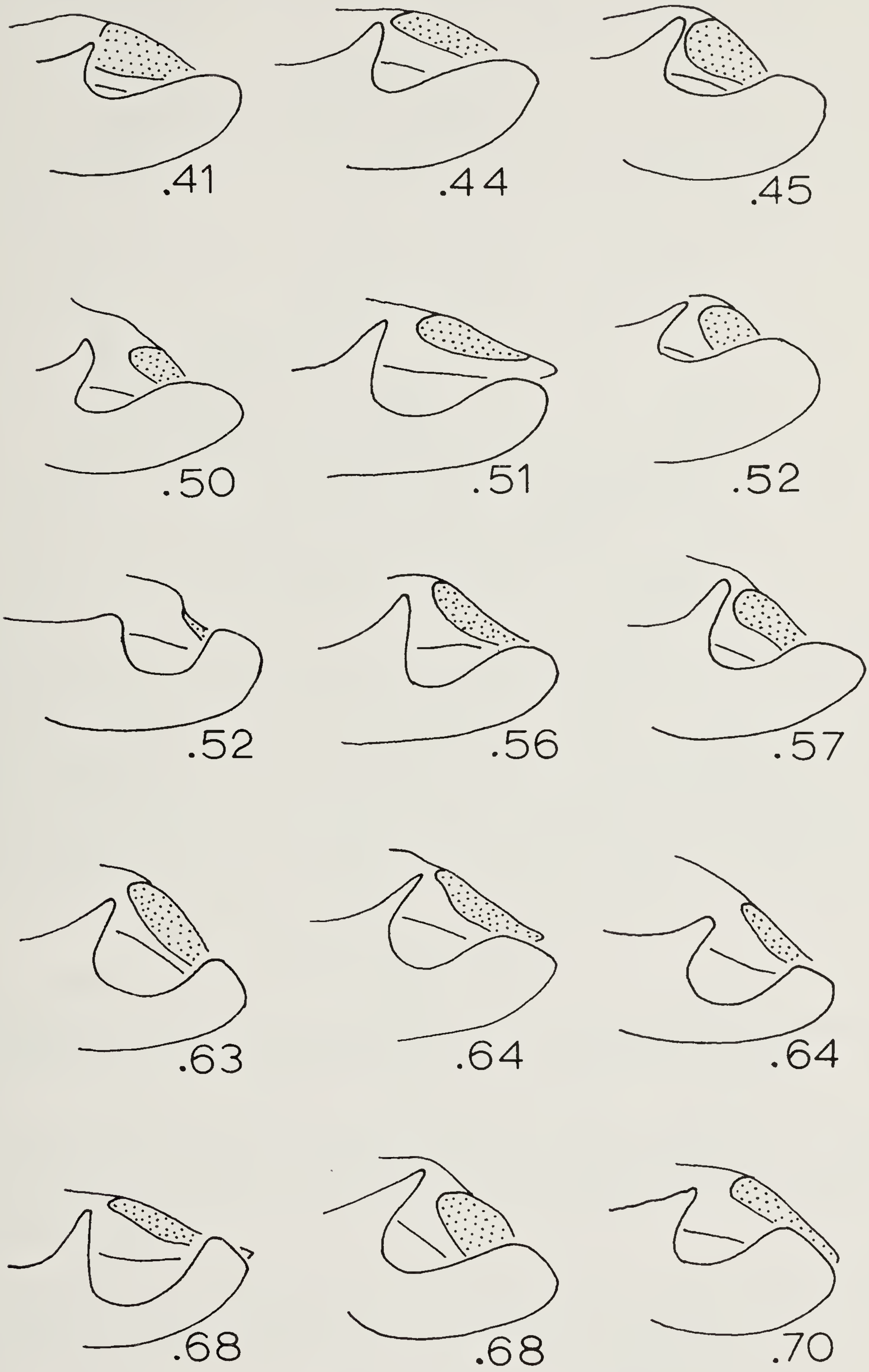

FIGURE 4. Right paramere and median lobe of intergrades collected in the Mohawk Valley.

the University of Michigan made helpful suggestions and criticisms on the manuscript.

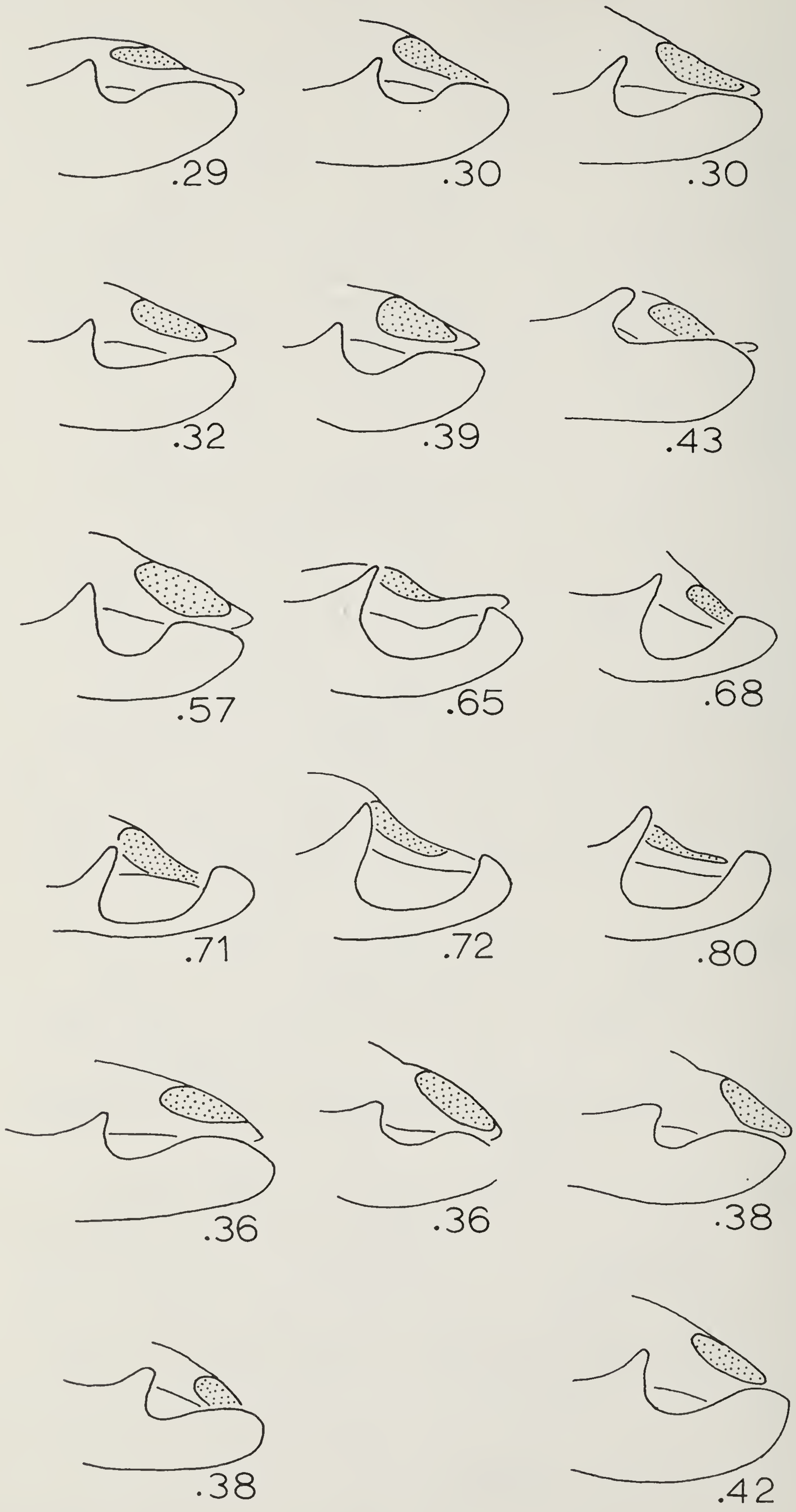

FIGURE 5. Upper seven (.29-.57) right paramere and median lobe of specimens collected in Albany County, 1890-1894. Drawings .65-.80 from specimens collected in Albany County, 1905-1920. Lower five "possible intergrades" (.36-.42), collected in Peoria and Menard Counties, Illinois; Franklin County, Ohio; Oakland County, Michigan; Wayndotte County, Kansas.

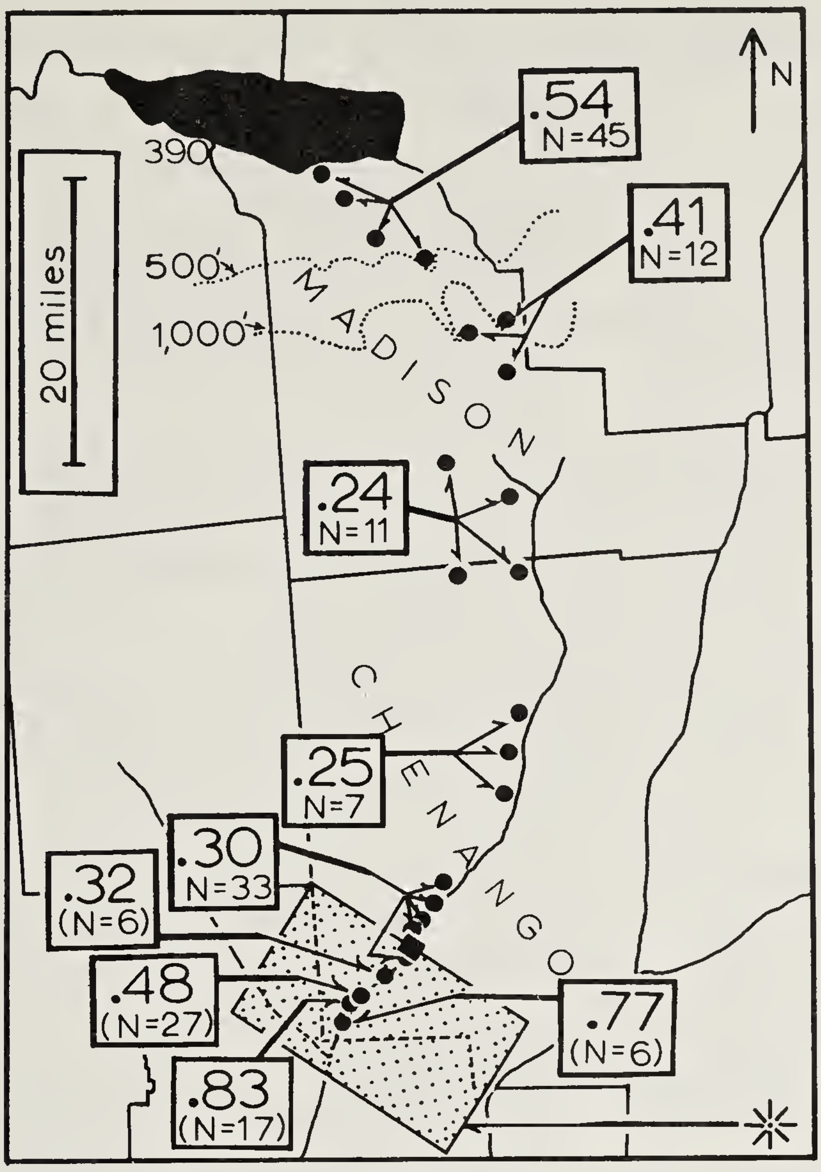

FIGURE 6. Sampling transect from Oneida Lake in Mohawk Valley southward to northern Broome County. Dots indicate sampling sites; black square at edge of stippled area is Greene; dotted contour lines indicate edge of Mohawk Valley; stippled rectangle indicates area of greatest study concentration. Sample means are shown in boxes; in the Chenango Valley only means for riverbank samples are given (see text). Distance between the .48 site and .83 site was less than 300 yards. The .83 value is higher than the mean value for *marginellus* samples made outside the area of sympatry ($\bar{x} = 0.76$, $n = 31$, range 0.60-1.0). This high value (.83) may be the result of sampling error, or may indicate genetic disturbance resulting from contact with *curtatus*.

*In the hills to the east and west of the Chenango Valley, $\bar{x} = 0.76$, $n = 36$, range = 0.62-0.93.

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Both the taxonomy of the species of the bembidiine genus Tachys Stephens, and of the species of the Tribe Pterostichini (in the widest sense), which are arranged in 11 genera, are treated in this part. A single page insert contains an addendum to the key to the species of Bembidion, published in Part 3.

The organization is the same as that in the preceding parts. The species are arranged in groups of about subgeneric rank (in the larger genera), genera, and tribes, and the pterostichine genera are included in subtribes. For each of the supraspecific taxa good descriptions are provided, comparisons are made with presumably related taxa, and characters of special importance for identification are discussed. References to descriptions of larvae are provided in conjunction with the descriptions of the genera. Keys are provided to the species of each genus, the keys following the descriptions of genera and preceding the descriptions of species. For each species the following is presented: a synonymy; a short but adequate diagnostic description; data on geographical variation, distribution, ecology and vagility. For most of the species, illustrations are provided of diagnostic characteristics, usually of the pronotum and male genitalia. The illustrations are of the very high quality of those in the preceding Parts, and are most useful in making identifications. The illustrations of the entire insects are excellent, but my impression is that most of them were reduced a bit too much.

In all, 230 Nearctic species are treated, of which 195 occur in Canada and Alaska. Of this number, 11 were accidentally introduced from the Palaearctic Region. The "extra-limital" species are found in the United States (excluding Alaska), and all except one are included in the keys. Eight species are described as new and 387 synonyms are recorded. Of these, 193 or almost half, were proposed by one man, Colonel Thomas Lincoln Casey. In contrast, 13 of the taxa recognized as species in this volume were named by Casey.

The 28 species of Tachys treated herein are arranged in seven groups, six of which are Holarctic. The key is an improvement over Hayward's, and the illustrations of male genitalia and other characteristics greatly facilitate identification of these small rather uninteresting carabids. Although this large, mainly tropical, genus reaches the northern end of its range in Canada-Alaska, it is ecologically diverse in this area: in addition to the stream-lake-margin species are two halophiles, two myrmecophiles, and four species living under the bark of dead and dying trees.

The tribe Pterostichini has been enlarged by the inclusion of the Agonini, and the genera are grouped in four subtribes: Pterostichi-Stomis Clairville, Myas Dejean, Pterostichus Bonelli, Abacidus LeConte, and Loxandrus LeConte; Synuchi-Synuchus Gyllenhal; Sphodri (Calathi)- Calathus Bonelli, and Pristonychus Dejean; Agoni- Olisthopus Dejean, Agonum Bonelli, and Atranus LeConte. Although the Pterostichi, as Lindroth shows, cannot be separated from the remaining groups by any trenchant characteristics, still the habitus of these beetles seems to me

(Continued on page 56)

BOMBARDIER BEETLES (COLEOPTERA, CARABIDAE) OF NORTH AMERICA: PART II. BIOLOGY AND BEHAVIOR OF BRACHINUS PALLIDUS ERWIN IN CALIFORNIA[1]

By TERRY L. ERWIN[2]

Very little is known about the life history of bombardier beetles even though the group is plentifully represented in most parts of the world. Brief references have been made to the larvae of these interesting beetles, and the papers have dealt mostly with descriptions of first instar larvae of species of either *Brachinus* or *Pheropsophus*. In this paper I describe the immature stages of *Brachinus pallidus* Erwin, 1965, discuss the life history and behavior of these beetles, and review all available life history information concerning the bombardier beetles.

Wickham (1893:330) recorded the larval habits and parasitic relationships of *Brachinus* to water beetle pupae. He briefly described and illustrated the last instar larva and pupa of *B. janthinipennis* (Dejean).

Dimmock and Knab (1904:30) included Wickham's observations in their own publication on immature Coleoptera. Their work is much better known than that of Wickham's and they have erroneously been given credit in subsequent literature for the first discovery of *Brachinus janthinipennis* larvae.

A. de Orchymont (1920:59) noticed the similarities between the biology of *Lebia scapularis* Fourcroy and *B. janthinipennis* (Dejean) and predicted the existence of a free-living first instar for *Brachinus*.

Van Emden (1919:34) has described the first instar larva of *Pheropsophus* which were reared from eggs deposited by adults of *P. hispanicus* Dejean in the Canary Islands. Boldori later (1939:173) reared and described the larvae of *Pheropsophus africanus* Dejean. Boldori did not rear them beyond the first instar probably because of their special food requirements. Habu and Sadanaga (1965) described the first instar of *B. (Brachynidius) incomptus* Bates and worked out part of the life history of *Pheropsophus jessoensis* Morawitz. The descriptions are detailed and are accompanied by excellent illustrations. Jeannel (1942:1104) repeated Van Emden's description and reviewed those finds made by Wickham.

Recently, Wautier (1963) described the first instar larva of *Brachinus (Brachynidius) nigricornis* Gebler. This description is detailed and is accompanied by excellent illustrations.

In August of 1965, I discovered many pupae of the hydrophilid beetles *Tropisternus ellipticus* (Le Conte) and *Berosus punctatissimus* Le Conte under rocks near the Gilroy Hot Springs area of Coyote Creek, in Santa Clara County, California. Almost every one had a small larva adhering to it. These small larvae were reared, and developed into adults of *Brachinus pallidus* Erwin and *Brachinus fidelis* Le Conte. Subsequent intensive field work resulted in the discovery of many of the older instars of *Brachinus pallidus* in their natural habitat.

Shortly after these discoveries at Coyote Creek, Dr. Carl H. Lindroth informed the author *(in litt.)* that a larva of *Brachinus* had been found in Canada feeding on the pupa of a hydrophilid beetle. Based up on these three separate observations (Wickham's, Erwin's, and Lindroth's), it is assumed that ectoparasitoidism[3] is obligatory for the post-embryonic development of at least the North American species of *Brachinus*. The entire life cycle of *Brachinus pallidus* will be discussed here, with descriptions and illustrations of all the immature instars.

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[1] From the author's thesis presented to San Jose State College (California) in partial fulfillment of the requirements for the degree of Master of Arts.

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Acknowledgements—Special thanks are due the following people who have contributed their time to the completion of this paper and the continuing study of bombardier beetles: J. Gordon Edwards and George E. Ball for critically reading this manuscript; La Verne J. Erwin (my wife), Anita Yamamoto, and Robert Anderson, for spending many hours in the field turning over rocks in search of the immature stages of *Brachinus*.

LIFE HISTORY AND GENERAL BIOLOGY

Mating—I observed pairs of *Brachinus pallidus* in coitus as early as May (in the laboratory) and as late as September (in the field). Mating was commonly observed throughout this period, occurring either at night or during the early morning hours, about dawn. Copulation usually takes place on top of a dry rock. The female beetle is mounted from the rear by the male which assumes the following position: fore-tarsi on the female pronotum, middle tarsi on the female elytral humeri and hind tarsi near the female elytral apices. The male's hind pair of legs rub the female's elytral apices during copulation. The antennae of both sexes are held straight forward, and the male's antennae palpitate the female's antennae during mating. In repose, the aedeagus of ground beetles is 90° counterclockwise from the true morphological position. As the aedeagus is extruded prior to copulation it rotates another ninety degrees counterclockwise, and is thus exactly upside down when fully extended. It is then directed forward under the male abdomen and enters the female genital chamber. The median lobe goes into the female as far as the parameres, which are small and are located at the base of the median lobe. It is not known whether the membranous apical sac, the endophallus of the aedeagus, completely inflates after insertion into the female genital chamber, but many authorities suspect that it does. The sclerotized tip of the endophallus, or virga (Snodgrass, 1939) is probably implicated in the copulatory process, but its exact function in *Brachinus* is not known. Actual intromission lasts only a few seconds, but the male remains mounted on the female for an hour or more if not disturbed.

Oviposition—Within a few days after copulation the female oviposits in the gravel near the stream or pond. Just prior to oviposition the female beetle becomes quite excited in her movements, running rapidly over the rocks and gravel. When she encounters a slightly muddy spot she begins the process of gathering a mud ball on the tip of her abdomen. The last two abdominal segments are used as a scoop. With back and forth motions of the entire body, the female scrapes a small packet of mud from the wet rocks or soil. This process continues for at least four or five minutes, until she has enough mud to form a ball at the abdominal apex. The female then again runs rapidly over the rocks and gravel until she locates a small, damp stone that is laying on the gravel. With the valvulae the egg is pressed into the center of the wet ball of mud at the tip of the abdomen, then the encased egg is released onto the damp rock. The time required for this process varies between species. *Brachinus fidelis* Le Conte requires a full minute to oviposit, while *B. pallidus* needs but a few seconds. Oviposition takes place about dawn, just before the nocturnal adults retreat to cover for the day. A female lays two or three eggs a day for several days.

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[3] Parasitoid is a term applied to parasites that normally cause the host to die in a short time.

The eggs are ellipsoidal, with blunt ends. They are white and smooth, and have no hooks or spines. The mud ball enclosing the egg may be almost any shape, but is usually oval.

ECLOSION—Within a week after oviposition the first instar larva of *B. pallidus* chews its way out of the egg and through the mud wall surrounding the egg. There is no "egg burster" on these first instar larvae as there is in most other carabids. Even *Pheropsophus* has an egg burster consisting of a single median spine (Van Emden, 1942a), which may represent a stage between the typical condition in carabids toward that of total absence in *Brachinus*.

LARVAL DEVELOPMENT—The first instar larvae of *B. pallidus* are typically caraboid in shape and behavior. These first instar larvae begin their active search for a host immediately after eclosion.

It is necessary here to relate a partial life history of the species of beetles upon which the two species of *Brachinus* in this study feed. *Tropisternus ellipticus* (Le Conte) and *Berosus punctatissimus* Le Conte are Hydrophilidae with aquatic larvae, but both have terrestrial pupae. The larvae of these species crawl away from the water of the stream, through the coarse gravel, until reaching a site beside a boulder resting on soil or sand. There they stop and begin thrashing about. This activity eventually causes a small chamber to form in the damp soil or sand beneath the larva, and it then pupates in that cavity beside and partially beneath the boulder.

The actual feeding begins on the prosternum of the pupa. This results in a reddish appearance at the site of mandibular puncture which spreads rapidly over the dying pupa. Fifteen hours after feeding has begun the entire pupa is dark red. Within a few hours the first instar moults to the second instar, without moving from its meal. The second instar is quite unlike the first. A change in the mouth parts is evident, along with a shortening and thickening of the legs. The abdomen begins to take on a swollen appearance. A short time after the second instar begins to feed, the host pupa dies and begins to turn a very dark reddish color. The *Brachinus* larva then moults to the third instar and continues feeding at an even faster rate. The feeding proceeds from the prosternum inward and then posteriorly. The moult to the fourth instar occurs between the twentieth and thirtieth hour after the first instar began feeding. The fourth instar finishes devouring the pupal host and then moults to the fifth instar. The hydrophilid pupa has been completely consumed by that time and all that remains in the pupal chamber is the fifth instar *Brachinus* larva, which pupates four to five days later, still within the hydrophilid pupal chamber.

PUPATION—Pupation of *Brachinus pallidus* and *fidelis* takes place in the chamber which the hydrophilid host originally formed. The pupal stage of *Brachinus fidelis* requires only eight days to develop at room temperature and emerge as an adult beetle. Since there is barely a trace of the hydrophilid pupa left in the chamber, it might appear to the casual observer that the *Brachinus* larva had formed the chamber, as do some other carabids *(Agonum)* in the same area. However, observation of the entire sequence of events has made it obvious that this is not the case. The *Brachinus* larva simply replaces the hydrophilid pupa in its cell after devouring it.

The pupae of these two *Brachinus* species are white and have several long, stout dorsal hairs, which keep the body free of the damp substrate and may thus protect it from becoming too wet. In all cases observed the pupae were supine in the chamber, supported on the long hairs. The *Brachinus* pupa begins darkening within three days after pupation occurs. The mandibles and eyes darken first, then the rest of the body turns a pale yellowish color. The new adults are totally white, except for the mandibles and the eyes which are black. Pigment deposition begins almost immediately and is complete in about four to six hours. Hardening of the cuticle requires several days or weeks to complete.

EXTERNAL MORPHOLOGY OF IMMATURE *Brachinus pallidus* ERWIN

The larvae of both *Brachinus pallidus* Erwin (and also *Brachinus fidelis* Le Conte) undergo two-stage polymorphic metamorphosis. The first instar larva is typically carboid except for the tarsunguloid legs, absence of a ligula, and short non-segmented urogomphi. The second through the fifth instar larvae have somewhat reduced legs and mouth parts and do *not* resemble normal caraboid larvae.

First instar larva (Photographs 1, 2).—The first instar larvae are about 3.2 mm in length, but the size varies somewhat, depending upon the size of the female that laid the egg. The head and thorax are distinctly sclerotized and pigmented, but the abdominal segments are soft and very lightly pigmented dorsally. Setae of various sizes and lengths occur both on the head capsule and the body. There are no egg busters as have most other carabids, thus it is probable that the larva simply chews its way out of the egg. *Head* (Plate 2, figures 1, 2). Head large and square, prognathus and depressed. Epicranial suture narrowly "U"-shaped, enclosing a fused frons and clypeus. Fronto-clypeal area modified into a nasale, which is rounded anteriorly and bears no teeth. Front piece barely convex. Cervical region slightly constricted and very short. Mandibles strong sickle-shaped, deeply pigmented and each with a small retinaculum at basal third. Antennae 4-segmented with first, third and fourth articles bearing long setae and third and fourth articles also bearing several sensory papillae. Third article dilated and bearing four of these small, knob-like sensory papillae; two located dorsally toward lateral lobe and two located ventrally below lateral lobe. Lateral lobe with a supplementary process resembling a small transparent bubble. Fourth article with three sensory papillae and four long setae, all of which are located terminally. Two distal sensory papillae of fourth article long and pencil-like, while the third papilla is spinelike and is located laterally at the base of the other two papillae. Labium (prementum) without a ligula but with a pair of 2-segmented palpi. Venter of labium bears two long setae. Dorsum of labium bears four short setae. Last article of each labial palpus bears two short ventral setae. Maxillae well developed, each with a basal cardo, a long curved stipes, a 4-segmented palpus and a long, ridged mala. Cardo with one ventrally located seta. Each stipes bears four setae, two of which are ventral-lateral and two on the mesal edge. Mala (a single apical lobe of maxilla, formed of the fused galea and lacinia) about two-thirds the length of the maxillary palpus and bears six setae and one anterior mesal sensory papilla. Each palpus with a ventral seta on first article, a dorsal seta on second article, and two ventral setae and one dorsal seta on third article. Organs of vision consist of six stemmata on each side of head capsule, arranged in two vertical rows of three per row. Stemmata located laterally, and caudad to base of mandibles. They are surrounded by darkly pigmented granules. *Thorax*. Prothorax at middle slightly broader than head and equal to it in length. *Legs* (Plate 3, figure 5). Legs twice as long as corresponding thoracic segments are wide. *Abdomen.* Abdomen 10-segmented, with lightly pigmented dorsal sclerites. Urogomphi very short, unsegmented, and non-sclerotized, each bearing five long setae (one near base and four in a ring near apex). Pygopod (uropod, or tenth segment) well developed and divided terminally into two lobes (Plate 1, figure 3). This structure is well developed for locomotion and helps the larva adhere to the pupa it parasitizes.

Second instar larva (Photograph 3).—The second instar larvae are about 4 mm in length, with the abdomen being very white and soft, and they have lost the typical caraboid appearance. Cephalic pigmentation is lacking, although there is faint sclerotization. *Head* (Plate 2, figures 3, 4). Head smaller in relation to body size than in first instar. It is more rounded, rather than being square. Epicranial suture "U"-shaped. Labrum and clypeus partially differentiated, thus not forming a true nasale. Frons flat, rather than convex. Cervical region of head constricted and very short. Head capsule with darkly pigmented lines near the cervix, but faintly sclerotized areas extend beyond these lines, gradually becoming membraneous posteriorly. The inflated body segments begin with the prothorax, making the head appear very small in proportion to the body. Mandibles reduced in length (compared to first instar mandible-head ratio). They are short and arcuate rather than being long and sickle-shaped. Small retinaculum present at basal third of mandible. Antennae 4-segmented, with third and fourth articles bearing long setae and sensory papillae. Third article with one lateral papilla and fourth with two apical papillae. Lateral lobe of third article with a supplementary process resembling a small knob, but it is not at all transparent (as it was in the first instar). Labium without ligula. Venter of labium with two short setae. Labial palpi each 2-segmented. Maxillae reduced in comparison with those of the first instar, but still well developed. Each maxilla consists of a cardo fused to a long, straight stipes. Each maxilla bears three dorsal and three ventral setae, and also with a small mesal spine adjacent to labium. A 4-segmented palpus and a long mala occur near the tip of each maxilla. Mala about two-thirds as long as maxillary palpus and with two apical setae and two apical sensory papillae. One seta also is visible on the third segment of maxillary palpus. Venter of head capsule with two tentorial pits near the center. Organs of vision are represented by six pigmented areas on each side of head, arranged in two vertical rows of three in a row (sometimes there are only five on the right side of the head). There are no definite functional stemmata, as there were in the first instar. Pigmented areas located laterally and caudad to each mandibular base. *Thorax.* Prothorax broader and slightly longer than head capsule. *Legs.* All legs very short, only about as long as head. *Abdomen.* Abdominal segments soft, and proportionally broader than in the first instar, and each segment also expanded into large white lobes ventrally. Urogomphi very short, non-segmented, and soft, each bearing five long setae (one basally and four actually on the urogomphus). Pygopod relatively shorter than on first instar, and modified in the second and subsequent instars into a short anal tube.

Third instar larvae (Photograph 4).—Third instar larvae about 6 mm in length similar in form to second instar larvae. Cephalic pigmentation entirely lacking, although there is slight sclerotization. *Head* (Plate 2, figures 5, 6). Head smaller in proportion to body size than in previous instars, but resembles head of second instar by being rounded, rather than square. Epicranial suture "U"-shaped, enclosing the fused labrum and clypeus. Frons and clypeo-labral areas fused into a single central lobe. Front slightly concave at sides rather than being flat. Cervical region of head constricted and short. All body segments are swollen, including the prothorax, making the head seem very small in proportion to the rest of the body. Mandibles even more reduced than in second instar, being very short and stubby rather than long and sickle-shaped. Small retinaculum present at basal third of each mandible, and a short stiff seta occurs on lateral edge of each mandible opposite retinaculum. Antennae 4-segmented, with the third and fourth articles bearing short setae and small sensory papillae. Third article with two sensory papillae apically, one laterally and one mesally, and fourth article with an apical papilla. There is no supplementary process as there is in the first two instars. Labial palpi each 2-segmented, and the venter of the labium bears two short setae. Maxillae short and stubby, each consisting of a stipes fused to the cardo. Stipes with two setae, one laterally and one ventrally. At apex of each stipes there is a 4-segmented palpus and a long thin mala. Mala and palpus both devoid of setae in this instar. Venter of head capsule with two tentorial pits near the center as in other instars. Sides of head similar to those of the second instar but with fewer pigmented granules. *Thorax.* Prothorax broader and slightly longer than head. *Legs.* Legs very short, only being about the length of head. *Abdomen.* Abdomen 10-segmented and very soft. The middle abdominal segments are expanded, each with eight lobes beneath. Urogomphi very short, unsegmented, and soft, each bearing five long setae (one basally and four actually on the urogomphus). The pygopod of the first and second instars has been entirely lost in this stage.

Fourth and fifth instar larvae (Photographs 5, 6).—These two instars look almost identical. They are 8-10 mm in length if the host pupa was *Tropisternus,* but only 6-7 mm long if they fed on the pupa of *Berosus.* The resemblance to the third instar is evident. The lack of cephalic pigment, the soft, expanded abdominal segments, and the setal arrangements on the head and body are all characteristic of all of these older instars. *Head* (Plate 3, figures 1, 2, 3, 4). Head rounded and small, as in third instar. Epicranial suture more visible than in third instar enclosing a well developed frontoclypeal area. Frons flat, rather than concave. Cervical region of head present, but short. Mandibles thick and flat, with a larger retinaculum than in third instar. Each mandible bears a lateral seta at basal third. In the last two instars the antennae become 5-segmented because of a subdivision of the original first article of younger instars. In the fourth instar the first, third, fourth and fifth articles bear short setae, one dorsally and one ventrally on first article, one mesally on third article, and four setae forming a rosette on each fourth and fifth articles. Fifth instar antenna similar, but only bears three setae in the apical rosette of the fifth segment. Antennae of both instars lack visible sensory papillae and supplementary processes. Labium still consists of two palpi, each being distinctly 2-segmented, and venter of labium with two short setae. Maxillae very short and stubby, each consisting of a fused cardo and stipes. Near the apex of each stipes is a 4-segmented palpus and a short mala. The stipes bear two setae, one laterally at middle and one ventrally at base. Mala devoid of setae in these instars, but maxillary palpus with two setae, one laterally on first segment and one laterally on third segment. Venter of head capsule with two tentorial pits near center, as in other instars. Fourth instar with organs of vision similar to those of two preceding instars, but with fewer pigmented granules.

Fifth instar with *no* pigmented granules and *no* stemmata. *Thorax*. Prothorax broader and slightly longer than head. *Legs* (Plate 3, figure 6). Legs very short, only being about the length of head. *Abdomen* (Plate 1, figure 1). Abdomen much the same as in the third instar, with similar urogomphi and with setae in the same positions.

Description of Pupa (Photograph 7).—Pupae of *B. pallidus* and *B. fidelis* typically caraboid. They have long dorsal hairs that support them while in their damp pupal chamber. Pupae white at first, then the eyes and mandibles begin to darken. Rest of the pupa yellows before emergence. Pupae with head tucked under prosternum and between retracted fore and middle legs. Antennae pass under eyes and then wrap around femora, paralleling retracted tibae. Long wing pads directed ventrally between middle and hind legs. Antennal apex, maxillary palpi, and all tarsi lie close together along ventral midline of abdomen. Head with four supraorbital setae on each side. Prothorax with a row of long setae near each edge and four short setae laterally on disc. Mesothorax and metathorax, and all abdominal segments have each two transverse rows of long setae dorsally. In addition each abdominal segment has a small, fleshy tubercle laterally (Plate 1, figure 2) and two long, thick setae and four to six short finer setae arise from each tubercle.

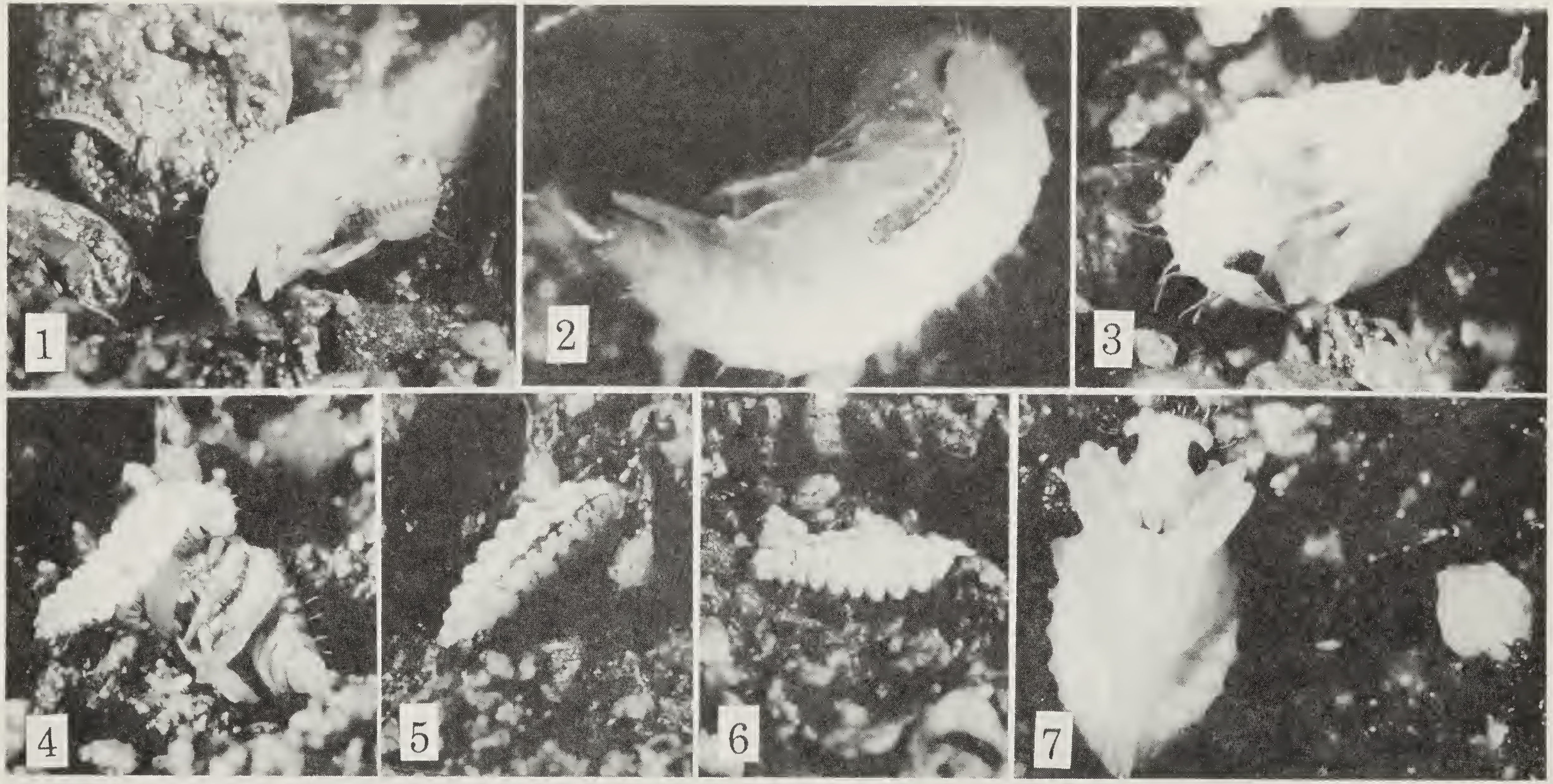
BEHAVIOR OF BRACHINUS LARVAE

The first instar *Brachinus* larva runs actively through the gravel and under algal mats near the water's edge. When it encounters a water beetle larva or pupa suitable for development, the *Brachinus* larva enters the water beetle's pupal chamber and crawls upon the pupa. The larva roams all over the pupa, using its pygopod for locomotion, but usually begins to feed on the prosternum of the host pupa. A possible reason for selecting that site may be that the pupal head is tucked under the thorax and provides a convenient place into which the larva can wedge firmly. Normally the thrashing of the pupa would be enough to throw off the parasitoid, but after it is wedged in the tight crevice between the head and the prosternum, the larva is apparently difficult to dislodge.

Larvae of *B. pallidus* have been found associated with both the pupae and larvae of *Tropisternus ellipticus* (LeConte) and with pupae of *Berosus punctatissimus* LeConte. Feeding has been observed on the pupae of both these hydrophilid beetles. In both cases adulthood was reached, but the respective *Brachinus* adults were of different sizes, probably due to the difference in size of the two kinds of hosts (these *Tropisternus* pupae are about a third larger than the *Berosus* pupae).

As many as five first instar larvae of *Brachinus pallidus* Erwin have been found on one *Tropisternus* pupa, and two first instar larvae were even found on one *Tropisternus* LARVA. One of the first instar *Brachinus* remained with the hydrophilid larva until the latter pupated, then began feeding on the pupa. In the cases where more than one first instar larva was present on a live pupa or larva, there was never any fighting or double feeding involved. All *Brachinus* larvae departed except the first individual that began feeding. One of these left-over larvae was placed on another pupa, where it soon developed into an adult, just as it normally would have on the first host encountered.

After feeding begins the young larva will sometimes leave the host pupa for brief intervals, but it always remains within the pupal chamber. Subsequent stages of *B. pallidus* larvae are generally much less active than the first instar,



PHOTOGRAPH 1. Two first instar *Brachinus pallidus* larvae with the pupa of *Tropisternus ellipticus* in the pupal chamber of the latter. PHOTOGRAPH 2. First instar of *B. pallidus* on pupa of *T. ellipticus*. PHOTOGRAPH 3. Second instar of *B. pallidus* on pupa of *T. ellipticus*. PHOTOGRAPH 4. Third instar *B. pallidus* on pupa of *T. ellipticus*. PHOTOGRAPH 5. Fourth instar of *B. pallidus* with remains of pupa of *T. ellipticus*. PHOTOGRAPH 6. Fifth instar of *B. pallidus* in pupal chamber of *T. ellipticus* after the latter was consumed. PHOTOGRAPH 7. Pupa of *B. pallidus* in pupal chamber of *T. ellipticus*.

	Host	Later instars (3 to 5)				First instar larvae										
		Degenerate	Urogomphi	Claws per tarsus	Antennal segments	"parasitic"	Instars	Pygopod crochets	Urogomphi	Claws per tarsus	Ligula	Segments of outer lobe	Inner lobe present	Protheca	Retinaculum	Antennal segments
BRACHINUS	Water beetle pupae	+	+	1	5	+	5	-	+	1	-	1, 2	-	-	+	4
PHEROPSOPHUS	Mole cricket eggs	+	-	1	4	+	?	-	-	2	±	2	-	-	-	4
SPHALLOMORPHA	Ant nest	+	-	2	4	+	3	?	-	2	+	?	-	-	-	?
LEBIA	Chrysomelid pupae	+	-	2	4	+	3	-	+	2	-	2	-	+	?	4
PELECIUM	Beetle pupae or millipeds	+	?	?	?	+	?	?	?	?	?	?	?	?	?	?
ORTHOGONIUS	Termites	+	-	1	4	+	3	-	-	1	+	2	+	-	+	4
ARSINOE	Tenebrionid larvae	-	+	2	4	+	?	+	+	2	+	2	-	+	+	4

TABLE I. Summary of characters known on "parasitic" carabid larvae; plus (+) indicates presence of listed characters; minus (-) indicates absence; numbers indicate number of segments, stages, etc.

but the second, third, and fourth instars also often leave the host for brief intervals and roam about inside the pupal chamber. If any instar (two through five) is disturbed by a touch or by strong illumination, the following characteristic reaction occurs. The larva lifts its head and thorax into the air, away from the substrate, and at the same time the abdominal apex is also elevated. This action leaves the larva resting only on the second through fifth abdominal segments, which are lobed beneath.

The fourth instar of *B. pallidus* finishes eating the water beetle pupa, devouring everything except the pronotal plate and the top of the head capsule. It then moults into the fifth instar (Plate 1, figure 1), which remains inactive during the four or five days that elapse before pupation.

An attempt was made to feed the fourth instar on another pupa after it had finished the first one, in hopes that an exceptionally large specimen might result. The second host was not eaten. Future experimentation along this line is anticipated.

RELATIONSHIPS BETWEEN BRACHINUS AND OTHER CARABIDS

Many of the characters of the larvae of *Brachinus* and of *Pheropsophus* indicate that the bombardier beetles may be only remotely related to other Carabidae. At the same time, their gross morphology indicate that they are good carabids as the family is now defined.

Among the Carabidae only the genera *Brachinus, Lebia,* and *Pelecium* are known to have ectoparasitoid larvae. *Pheropsophus* larvae are degenerate in later instars, much the same as *Brachinus,* but feed on mole cricket eggs (Habu and Sadanaga, 1964). The Pseudomorphine, *Sphallomorpha* is also degenerate, but the food source is unknown. Moore (1964) suspects it may be fed by the ants with which it lives.

The antennae of carabid larvae are usually four-segmented, except for some members of the tribe Pterostichini (including Agonini) which have five-segmented antennae and those of the tribe Anthiini which have only three segments (Hinton, 1945). *Brachinus pallidus* larvae have four antennal segments in the first three instars and five segments in the last two instars. (A subdivision of the first segment takes place during the third moult.)

The mandibles of *Brachinus* larvae are typically caraboid in all instars with a small retinaculium at the basal third, but there is no basal prostheca as found in members of the Harpalini, Elaphrini, Trechini, and Lebiini. The presence or absence of a retinaculum losses its significance at higher taxic levels in the bombardier beetles because in *Pheropsophus* it is missing.

Unlike almost all other carabids, the larva of *Brachinus pallidus* has each maxilla equipped with a one-segmented galea (here called a mala) rather than the two-segmented form which arises from the stipes of most carabids. Some European *Brachinus* and the known *Pheropsophus* have a very small first segment and a long second segment. A lacinia is absent in immature *Brachinus* as well as in those of most other Carabidae. The inner lobe of the stipes (Van Emden, 1942) is also absent. The labial palpi are two-segmented (a condition common to most carabid genera) but the ligula is entirely absent in all *Brachinus* studied. All other carabid larvae (except *Lebia scapularis* and apparently *Pheropsophus jessoensis*) that have been examined possess a ligula, although in *Pheropsophus hispanicus* and in *Sphallomorpha* it is very small. As Lindroth points out (1960:33) the ectoparasitoid mode of life is associated with a secondary loss of the ligula. The only other carabids without a ligula are the larvae of *Trachypachus* and *Gehringia,* both of which are considered to be primitive on the basis of other criteria. Unfortunately, the food of the larvae of these genera is not yet known.

Nearly all carabids have five-segmented legs, with two claws per tarsus. The first instars of *Brachinus pallidus, nigricornis* and *incomptus* have five segments in each leg, but only one claw per tarsus. In all other instars there are only three segments, a condition found elsewhere only in the degenerate instars of *Lebia,* and *Pheropsophus. Pheropsophus* again diverts from *Brachinus* in having two claws per tarsus in the first instar.

The abdomen of *Brachinus* is 10-segmented with a pair of dorsal urogomphi on the ninth segment, a condition common to most carabid genera, but the urogomphi are unique in *Brachinus.* The first instar has short urogomphi about one-third the length of the pygopod. In later instars the urogomphi are much shorter in relation to the body length, but longer in relation to the pygopod. This holds true in *B. sensu stricto* and in *B. (Brachynidius)* and may be related to the parasitoid way of life. In *Pheropsophus, Sphallomorpha,* and *Orthogonius,* all of which have larvae which are parasitic or symboint, the urogomphi are entirely absent. In the first instar of *Brachinus* the tenth segment is tubular and serves as a pygopod, but there are no sclerotized crochets at the apex as there are in some other carabids. Instead, a pair of adhesive protrusible vesicles occurs at the apex of the pygopod of larvae of *Brachinus,* which apparently serves very well as an effective and in rapid locomotion.

The greatest differences between *Brachinus* and most other genera of carabids are in the developmental biology. In all other known carabids there are only three larval instars and the third moult releases the pupa. *Brachinus,* however, undergo five moults, with the fifth moult releasing the pupa. Van Emden (1942) suggests that perhaps the Helluonini may have more than three larval stages.

Conclusions about the phylogenetic relationships of the Brachinines must await discoveries of the immature stages of the other genera in the group, with work such as that done by Wautier (1964). The adult beetles are very closely associated with similar habitus and habits, but as I have shown here, the *Brachinus* and *Pheropsophus* larvae are quite unalike. Moore (1964) suggests that the similarities between *Sphallomorpha* and *Brachinus* at the larval level supports Jeannel's Balteifera at the adult level, that is, the concept of a separate group uniting the Pseudomorphinlae and the Brachininae. The actual characters of the larva of Moore's *Sphallomorpha* are more similar to those of *Pheropsophus,* but these apparent affinities may be a result of structural degeneration of the parasitoid larvae. Comparisons such as Moore's might have much more validity if the first instar larvae were used, rather than the degenerate later instars.

SUMMARY

A historical summary of life history information is given concerning the bombardier beetles. The life history of *Brachinus pallidus* Erwin is discussed in length and illustrated with photographs of all instars. The external morphology of all instars of *B. pallidus* larvae and pupae is described and illustrated. The behavior of these larvae is discussed in detail; and finally, relationships between *Brachinus* and other carabids are discussed. More work must be done at the larval level before true phylogenetic relationships can be established for the bombardier beetles.

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PLATE 1

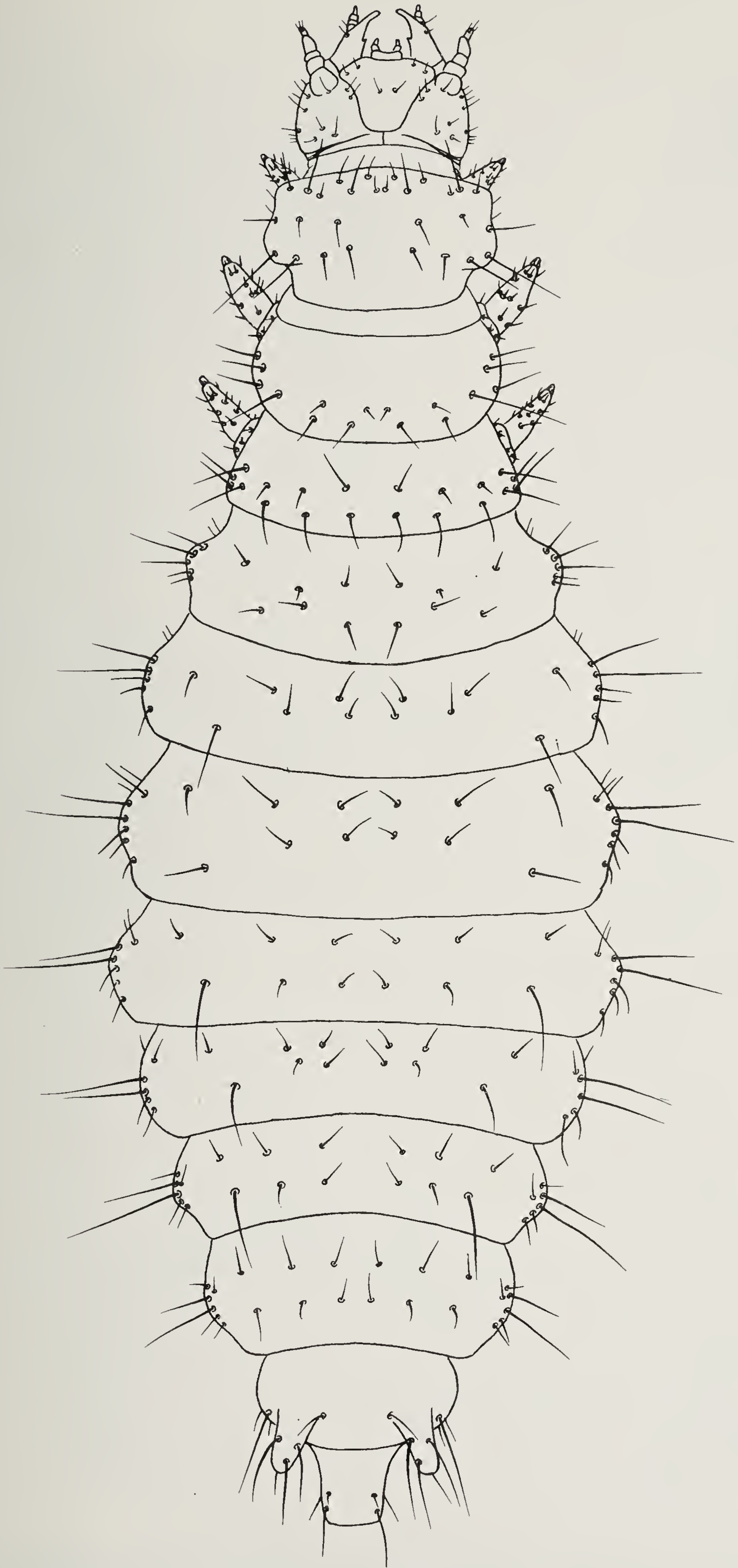

FIG. 1.

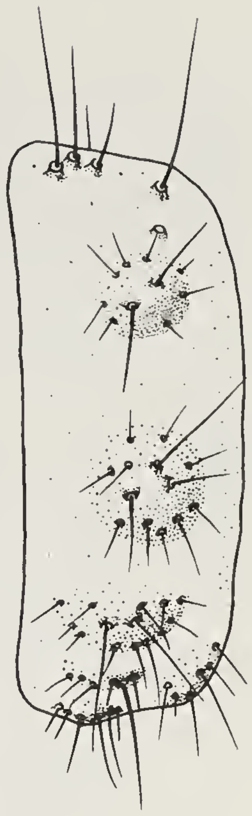

FIG. 2.

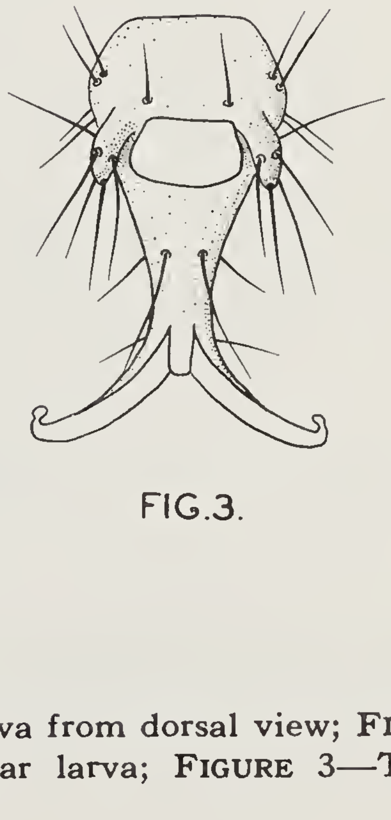

FIG.3.

PLATE 1. *Brachinus pallidus* Erwin. FIGURE 1—Fifth instar larva from dorsal view; FIGURE 2—Lateral view of the second abdominal segment of fifth instar larva; FIGURE 3—Tenth abdominal segment of first instar larva from dorsal view.

PLATE 2

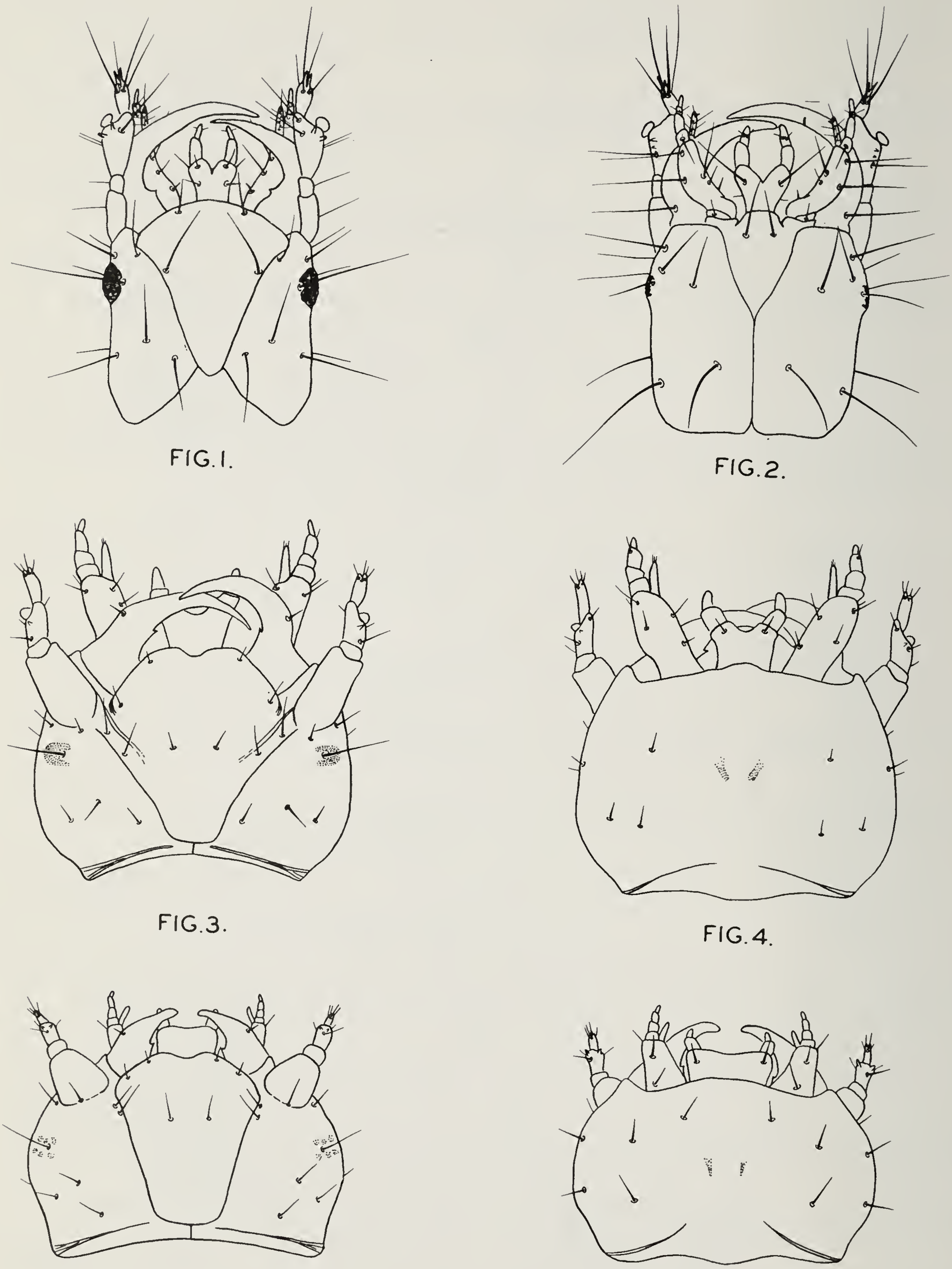

FIG. 1. FIG. 2. FIG. 3. FIG. 4. FIG. 5. FIG. 6.

PLATE 2. *Brachinus pallidus* Erwin. FIGURE 1—Head capsule of first instar larva from dorsal view; FIGURE 2—Head capsule of first instar larva from ventral view; FIGURE 3—Head capsule of second instar larva from dorsal view; FIGURE 4—Head capsule of second instar larva from ventral view; FIGURE 5—Head capsule of third instar larva from dorsal view; FIGURE 6—Head capsule of third instar larva from ventral view.

PLATE 3

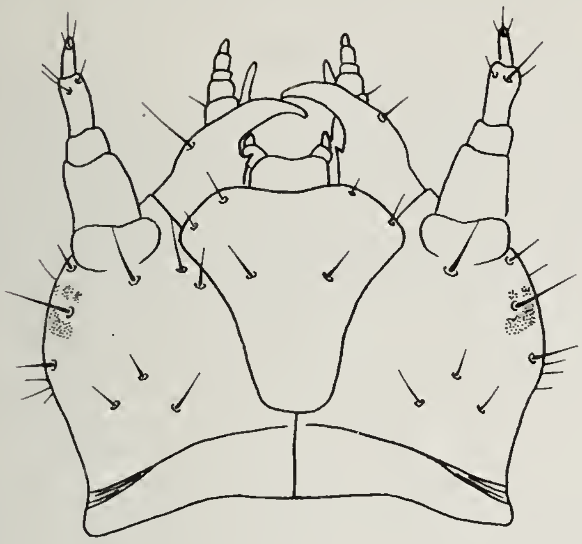

FIG. 1.

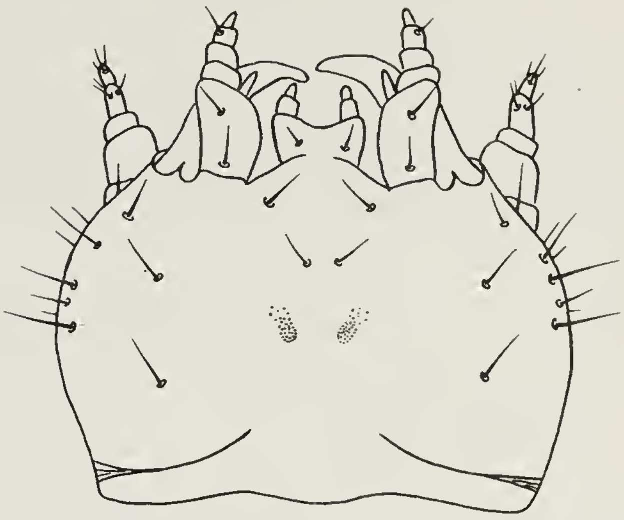

FIG. 2.

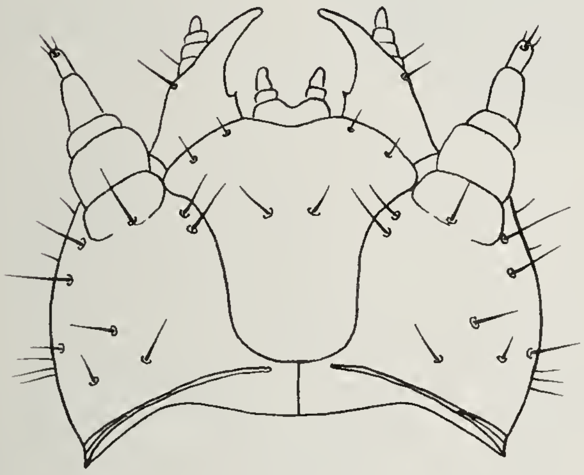

FIG. 3.

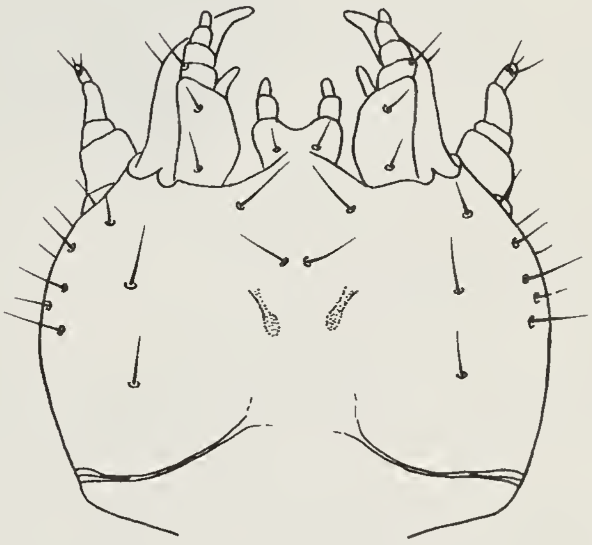

FIG. 4.

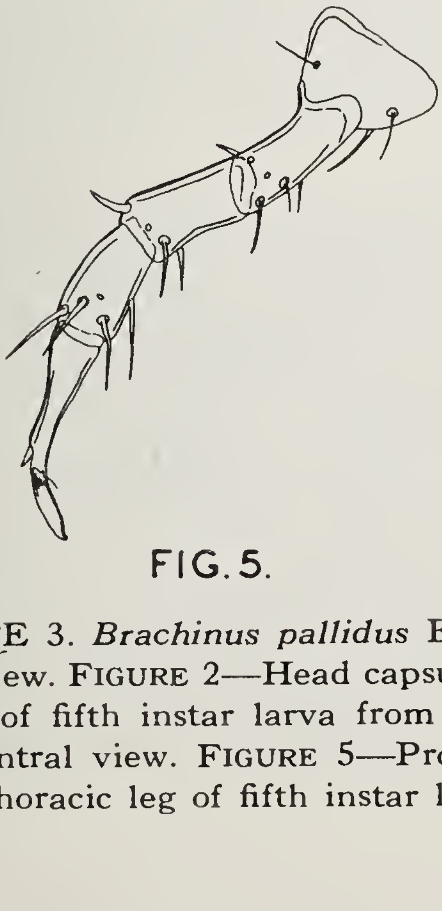

FIG. 5.

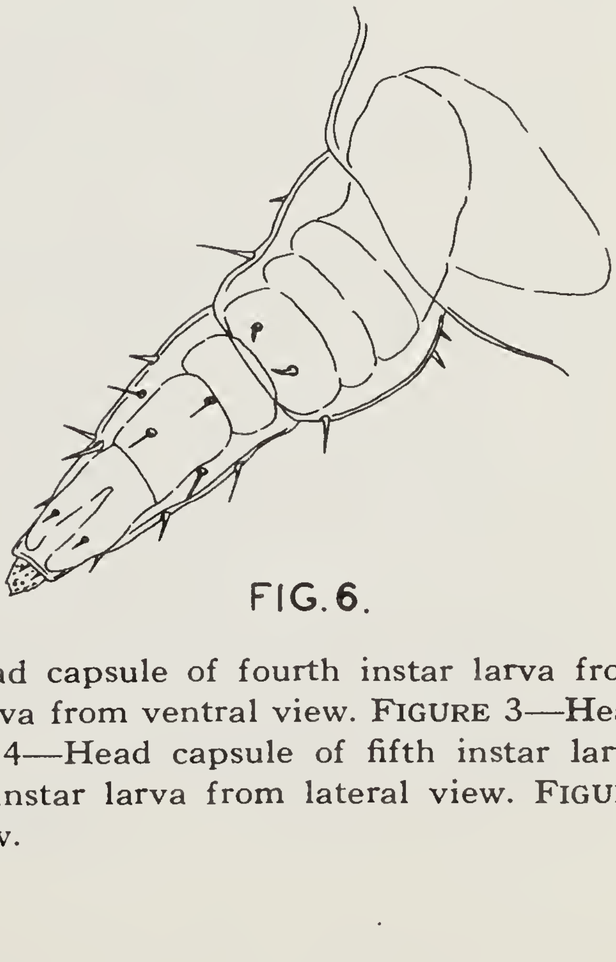

FIG. 6.

PLATE 3. *Brachinus pallidus* Erwin. FIGURE 1—Head capsule of fourth instar larva from dorsal view. FIGURE 2—Head capsule of fourth instar larva from ventral view. FIGURE 3—Head capsule of fifth instar larva from dorsal view. FIGURE 4—Head capsule of fifth instar larva from ventral view. FIGURE 5—Prothoracic leg of first instar larva from lateral view. FIGURE 6—Prothoracic leg of fifth instar larva from lateral view.

quite different from that of the "traditional" agonines (Synuchi, Sphodri, and Agoni), and on this basis I feel inclined to follow the North American tradition and treat the Pterostichi as a tribe distinct from the other three groups.

The "pterostichous" genera *Stomis*, *Myas*, and *Loxandrus* are represented by few species in this volume (one, two, and three, respectively), and require no special comment. The genus *Oxycrepis* accidently recorded by me in 1960 as occurring in Canada is excluded. The 87 species of *Pterostichus* (81 Canadian-Alaskan, 6 U. S. ; plus a few Palaearctic species, briefly compared with their Nearctic counterparts) are arranged in 23 species groups, of which 12 are Holarctic. All six species of *Abacidus* are included in the key, but only one species occurs in Canada.

The necessity for description of four new species of moderate-sized *Pterostichus* may seem rather strange, but it is easily accounted for. Three of these are known only from the western arctic and high subarctic regions and from few localities there (*circulosus*, two localities - this is the only endemic Nearctic species of the Holarctic *circulosus* group (subgenus *Steropus*); *nearcticus*, one locality - the only North American species of the Holarctic *nearcticus* group (subgenus *Derus*); and *kryzhanovskii*, an amphiberingian species strikingly similar to *haematopus* Dejean, and known from a single Alaskan locality). The fourth species *neobrunneus*, *amethystinus* group (subgenus *Hypherpes*) was confused by previous authors with other species of *Pterostichus*, and was thus unnamed.

The classification of the Canada-Alaska Pterostichi departs from my 1960 arrangement in that *Evarthrus* LeConte is included as a species group of *Pterostichus* (*sigillatus* group), and in contrast, *Abacidus* LeConte is treated as a genus distinct from *Pterostichus*. For the elevation of *Abacidus* to generic rank, the author gives these reasons: the species are *Calathus*-like in habitus, and further, the right paramere is *Calathus*-like. It is suggested that *Calathus* and *Abacidus* are related. The implication is that *Abacidus* is closer to *Calathus* than is *Pterostichus*, and further it is implied that the best way to indicate this fact is to treat *Abacidus* as a taxon of the same rank as *Calathus* and *Pterostichus*. Now, the form of the right paramere is quite variable within the genus *Pterostichus*, and I am therefore a bit dubious about accepting as evidence of relationship at a moderately high level, similarity among groups in the form of this organ. Furthermore, although there is a general similarity in body form between *Calathus* and *Abacidus*, it does not seem to me to be a particularly detailed similarity. I really doubt that *Abacidus* and *Calathus* are closely related.

With reference to *Evarthrus*, this group is defined by very distinctive male genitalia, markedly different from those of other Pterostichi, and by a general habitus which is more suggestive of the subgenus *Cyrtonotus* of *Amara* than of other North American *Pterostichus*. Some species of *Evarthrus* have plurisetose labial palpi, a characteristic of the Amarini. These points could be used as arguments for recognizing *Evarthrus* as a genus distinct from *Pterostichus*, and they would not be very different from the arguments presented by Lindroth for according generic status to *Abacidus*. This discussion is not intended to either condemn or condone Lindroth's decisions (or my opposite ones!) but to point out that similar evidence has led to different conclusions in these two cases. The temptation to dismember *Pterostichus* (in the widest sense) is a strong one, and this temptation has been resisted by few who have worked with the group. By lowering one's

(Continued on page 58)

A NEW SPECIES OF ACMAEODERA (COLEOPTERA, BUPRESTIDAE)

By G. H. Nelson[1]

In the chaparral at Yarnell, Arizona, specimens of a new species of *Acmaeodera* were collected on the dead branches of live *Ceanothus* sp. shrubs. Thanks are due Dr. W. F. Barr of the University of Idaho for examining specimens and verifying that they represent an undescribed species.

Acmaeodera ceanothae, NEW SPECIES

(Fig. 1)

Moderate in size, slightly depressed; black above and below with aeneous tinge below, elytra with small yellow markings laterally; clothed with moderately short cinereous hair, semierect above, recumbent below, with a few black hairs intermixed above; anterior prosternal margin slightly sinuate and retracted; last visible abdominal sternite with well developed subapical plate.

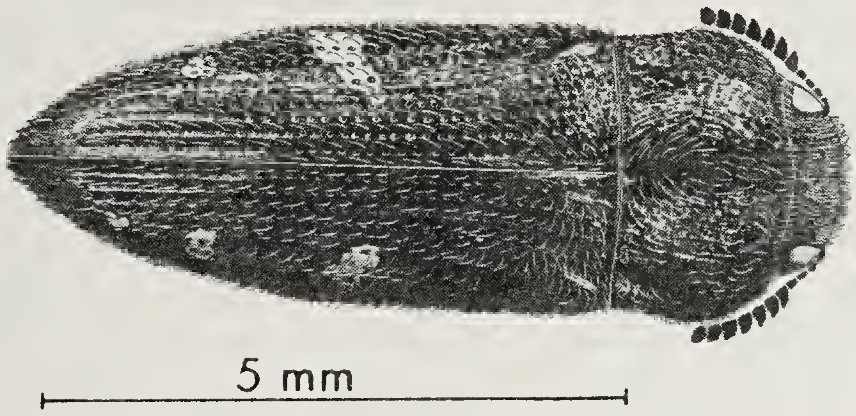

FIGURE 1, *Acmaeodera ceanothae* new species (type).

MALE—Head convex, densely clothed with semierect hairs; with dense moderate sized punctures becoming smaller on vertex; median carina on vertex; antennae serrate from the fifth joint.

Pronotum twice as wide as long; lateral margins gently expanded from before base to widest at middle then converging to narrowest at anterior angle; anterior margin slightly constricted and produced at middle, posterior margin straight; disk coarsely densely punctured at sides, punctures finer and sparse at middle, disk slightly depressed longitudinally at middle, with a small median pit at base and with an oblique depression passing anterolaterally from pit on each side near base; pubescence semierect at middle anteriorly, semirecumbent laterally and toward base.

Elytra widest just behind base, then gradually converging toward apex; lateral margins with serrations beginning at second fourth and becoming larger apically; disk with a transverse impression near base; strial punctures very coarse; each interval with a single row of bristle-like semierect hairs of moderate length; with lateral yellow spots as follows: at middle an oblique spot extending anteromedially, a smaller spot behind this and farther toward apex, a third smaller spot on right elytron.

Ventrally coarsely punctured on pro-, meso-, and metasterna and on first abdominal sternite, punctures smaller on other abdominal sternites; pubescence recumbent, moderate in length and density; prosternum with anterior margin retracted and very slightly sinuate; last visible abdominal sternite with strong subapical ridge.

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[1] Department of Anatomy, Kansas City College of Osteopathy and Surgery, Kansas City, Missouri.

Length 6.9 mm.; Width 2.4 mm.

FEMALE—Externally very similar to male with no apparent distinguishing differences. Allotype lacks a third yellow spot on elytra.

Length 8.2 mm.; Width 2.9 mm.

TYPE MATERIAL—Holotype male, allotype female, four male paratypes and two female paratypes collected from ARIZONA, Yavapai Co., Yarnell, June 26, 1964. Seven male paratypes and six female paratypes from the same place, June 27, 1964. One paratype of unknown sex was collected at the type locality by R. L. Westcott, June 26, 1966 on *Ceanothus* sp. All other type material was collected by G. H. Nelson on *Ceanothus* sp. Holotype deposited in the California Academy of Sciences. Allotype in the writer's collection. Paratypes deposited in the following collections: California Academy of Sciences, U. S. National Museum, W. F. Barr, F. M. Beer, J. N. Knull, D. S. Verity, G. C. Walters and R. L. Westcott.

There is some variation in the yellow spots with some specimens having a small fourth spot just behind the humeri. The males vary in length from 6.7 to 8.0 mm. and in width from 2.3 to 2.8 mm. The females vary in length from 6.5 to 8.2 mm. and in width from 2.2 to 2.9 mm.

This species, which belongs in Horn's "emarginatae," runs to *dolorosa* in Falls (1899) key and is most closely similar to *tenebricosa* Fall (1922) and to *dolorosa* Fall. From *tenebricosa* it differs in its shorter pubescence, its much smaller, fewer punctures in the center of the pronotum, and in its well developed subapical plate on the last visible abdominal sternite. From *dolorosa* it differs in its greater convexity, shorter pubescence, smaller, fewer discal punctures of pronotum, better developed subapical plate on the last visible abdominal sternite, and shorter genitalia in both sexes.

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FALL, H. C.
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(cont. from p. 56) generic standards slightly, it is easy to treat the presently recognized groups (or subgenera) as genera. It would be very interesting to attempt an analysis of degree of relationships among all groups of Pterostichus based on the methods of numerical or phenetic taxonomy, but such an analysis is best delayed until the pheneticists can achieve some degree of agreement on the methods to be employed, and on the significance of the results obtained.

Other changes noted are: 1. removal from the amethystinus group (subgenus Hypherpes) of the eastern adoxus Say to the mancus group (subgenus Monoferonia); 2. combining Dysidius Chaudoir and Paraferonia Casey in the mutus group; 3. combining Omaseidius Jeannel and Euferonia Casey in the melanarius group; 4. combining Melanius Bonelli and Metamelanius Tschitscherine in the corvinus group;

(Continued on page 63)

REVISION OF THE GREATER ANTILLEAN SPECIES OF PAEDERUS (COLEOPTERA: STAPHYLINIDAE)[1]

By Milton W. Sanderson[2]

Ing. Fernando de Zayas, Havana, Cuba, collected a small series of a black *Paederus* while beating vegetation in the Sierra Maestra in eastern Cuba in 1963. The species closely resembles in size and color *morio* Mannerheim (1830) from Haiti which I collected at Furcy in 1959, also by beating shrubby vegetation. The only other known species in the Greater Antilles is *jamaicensis* Blackwelder (1943) described from one female. From Dr. T. H. Farr, Institute of Jamaica, I secured specimens of *jamaicensis* including the unrecorded male. In addition to presenting a description of the Cuban species, I have added notes and records for *morio* and *jamaicensis,* including descriptions and illustrations of the male genitalia and especially the eighth sternite of the female.

Blackwelder (1936:86) described the female of the Central American *Paederus laetus* Er. as having a "sagittate sternite of the ninth segment which lies between and under the large valvifers." If I have interpreted his term 'sagittate' correctly, this structure lies dorsad of the sternite behind the eighth, therefore would seem to be a tergite. I have referred to these two structures and the valvifers in the descriptive notes. The males of these three species have the same arrangement of parts in the ninth segment (genital segment) as in the females although the parts may be somewhat differently shaped. The parameres in the males have lines of sensorial bristles and the females have setae on the eighth and ninth segments, not shown in the illustrations.

The three species treated in this report belong to the subgenus *Neopaederus* Blackwelder (1939:1943), distinguished from *Paederus* s. str. by the absence of hind wings, and obliterated basal elytral angles. Other species of *Neopaederus* occur in Central America, Mexico, the Nearctic Region, and the Old World. Two species of *Paederus* s. str. are known to occur on Trinidad, St. Vincent and Martinique in the Lesser Antilles (Blackwelder 1943).

Key to Paederus of Greater Antilles

1. Eighth abdominal sternite deeply notched; males 2
   Eighth abdominal sternite triangularly produced at middle of posterior margin as in Figs. 1 to 3; females 4
2. Body uniformly reddish-yellow or orange except last two abdominal segments contrastingly black; median lobe (n.l.) of aedeagus (Fig. 8) recurved at apex, parameres (Fig. 5) each narrowed, broadly s-shaped at apex; Jamaica .... JAMAICENSIS Blackwelder
   Body basically black; median lobe (n.l.) of aedeagus decurved (as in Figs. 7 & 9), parameres blunt or curved at apexes 3
3. Body black, elytra aeneous; seventh abdominal sternite longitudinally depressed, posterior margin emarginate; median lobe of last tergite acute at apex; parameres symmetrical (Fig. 6); copulatory sac of aedeagus with one curved process (Figs. 6 & 9); Haiti .... MORIO Mannerheim

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[1] This study was aided by a grant from the National Science Foundation.

[2] Illinois Natural History Survey, Urbana, Illinois.

Abdomen only black, elytra bluish, pronotum and head greenish; seventh abdominal sternite flattened, posterior margin straight; median lobe of last tergite blunt at apex; parameres (Figs. 4 & 7) asymmetrical, one shorter and differently shaped from other; copulatory sac of aedeagus (Fig. 4) with two curved processes; Cuba .... ZAYASI new species

4. Eighth sternite (Fig. 3) with three triangular lobes; color basically black; Haiti .... MORIO Mannerheim

Eighth sternite (Figs. 1 & 2) with median triangular lobe only 5

5. Median lobe of eighth sternite short (Fig. 1); color nearly uniformly black; Cuba .... ZAYASI new species

Median lobe of eighth sternite more elongate (Fig. 2); color reddish yellow to orange, last two abdominal segments black; Jamaica
JAMAICENSIS Blackwelder

Paederus jamaicensis Blackwelder

Paederus jamaicensis Blackwelder (1943:324)

This species was described from one female from Jamaica (British Museum) without further data. The author described it as "rufotestaceous throughout," adding that it might be immature. Through the courtesy of Dr. T. H. Farr, Institute of Jamaica, I have examined four specimens of this species, one of which Blackwelder identified. The latter individual, as well as all others examined, has the last two abdominal segments black in contrast to the rufotestaceous or orange foreparts of the body.

Records: Mt. Morce's Gap (4945 ft.), St. Andrew Parish, August 21, 1950, R. P. Bengry, 1 female. Hardwar Gap (ca. 4000 ft.), St. Andrew Parish, August 16, 1964, T. H. Farr, beating vegetation, 2 males, 1 female.

The striking bicoloration of *jamaicensis* will distinguish it from essentially black *morio* and *zayasi*. The median lobe of the male aedeagus (Fig. 8) is dorsally curved at apex instead of ventrally curved, and the apex of each paramere is broadly s-shaped. The copulatory sac (Figs. 5 & 8) bears a single curved process. The eighth sternite of the female (Fig. 2) has a long pointed median lobe, and the lateral angles of this sternite are broadly rounded. The ninth sternite is subtruncate at apex, not as narrow and emarginate as in *morio* and *zayasi*.

Paederus morio Mannerheim

Paederus morio Mannerheim (1830:39)

Paederus morio, Blackwelder (1943:324)

This species, the first of the genus recorded for the West Indies, was described from "Insula St. Domingo," and according to Blackwelder (1943) it is probable that the original specimens came from Haiti. Specific records are given in Blackwelder for Morne La Selle, Kenskoff, and Furcy—all in Haiti at elevations of 4000 to 6000 ft. Some of the specimens were taken by beating trees and shrubs. With Leonce Bonnefil and T. H. Farr I collected 11 males and 5 females at Furcy May 15 and 16, 1959 by beating shrubby vegetation. Blackwelder's description is sufficient for identification although in all my specimens the elytra were narrower instead of wider than the pronotum as described by him. The male aedeagus (Figs. 6 & 9) symmetrical except for the base of the process on the internal sac. Each paramere, as well as the median lobe, is ventrally hooked at apex. The apical margin of the eighth sternite of the female (Fig.

3) is tri-lobed, differing from *zayasi* and *jamaicensis* in which there is a single median lobe (Figs. 1 & 2).

Paederus zayasi Sanderson, new species

MALE—Color basically black, head and pronotum iridescent green, elytra iridescent blue; legs black; first three antennomeres yellow, remainder black. Head through eyes slightly wider than length measured from anterior margin of clypeus to nuchal constriction, irregularly setigerously punctured, with extremely fine and dense ground sculpture. Pronotum slightly longer than wide, widest slightly in front of middle, as finely and densely sculptured as head, and with a few scattered setigerous punctures. Elytra slightly narrower than pronotum, 1.2 times wider than long; suture about two-thirds as long as elytral length; surface uneven, with scattered setigerous punctures. Abdomen not as finely and closely sculptured as pronotum. Sternite of ninth segment broadened toward base, slightly asymmetrical, bluntly pointed at apex; dorsal lobe of ninth segment blunt at apex; valvifer acute, each strongly carinate on ventral margin. Aedeagus (Figs. 4 & 7) asymmetrical, one paramere elongate, parallel, rounded and thin at apex, other paramere not extending beyond apex of median lobe, blunt and slightly emarginate at apex, slightly pointed internally; median lobe strongly narrowed to an acute decurved apex; copulatory sac (Fig. 4) bearing two curved processes.

Length 9 mm; width 1.6 mm.

FEMALE. Similar to male in general appearance. Eighth sternite (Fig. 1) subtruncate at apex, sharply rounded at lateral apical angles, and bearing a short triangular median lobe; ninth sternite slightly emarginate at apex, median lobe (of ninth tergite) extending beyond ninth sternite, slightly ventrally curved.

TYPE LOCALITY—Cuba. Pico Turquino (6578 ft.), Sierra Maestra, Oriente Province.

TYPE SPECIMENS—Type male, 3 paratype males and one female collected June 1963, Fernando de Zayas. Zayas described the species as 'arboreal and it runs along the small branches of bushes like a big ant.' Type and paratypes in the collection of the Illinois Natural History Survey, paratypes in the collection of Fernando de Zayas. It is a pleasure to name this species after its collector with whom I spent many delightful days collecting in Cuba in 1959.

DISCUSSION—Superficially *zayasi* resembles the Haitian *morio* but close examination indicates many differences. The male seems somewhat isolated from *morio* and *jamaicensis* by its asymmetrical parameres (Fig. 4), and by having two processes on the copulatory sac instead of one as in the other species. The emarginate ninth sternite of the female (Fig. 1) is similar to that in *morio*, and the blunt median lobe of the eighth sternite in *zayasi* is more like that of *morio* than the acute lobe in *jamaicensis*.

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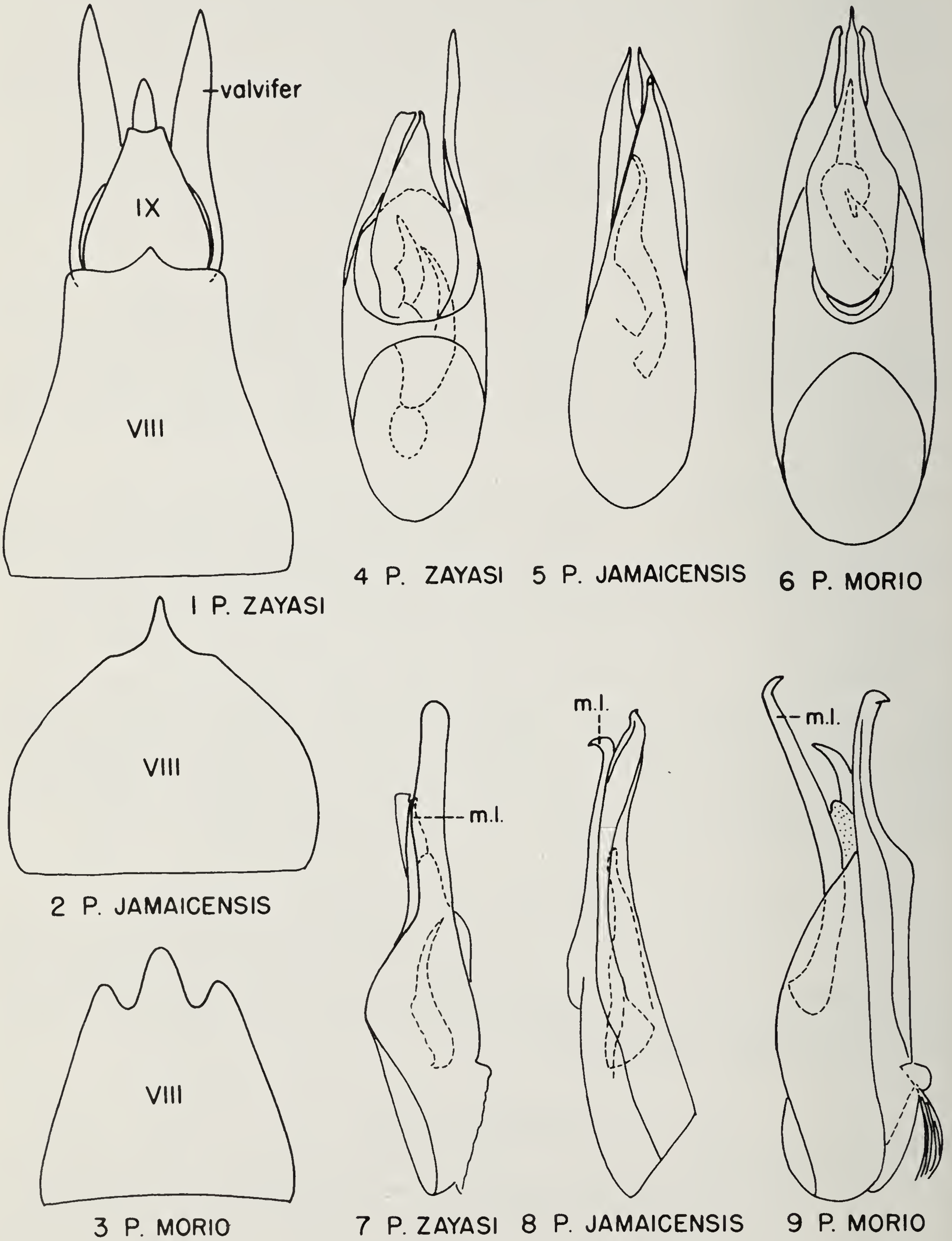

FIGURE 1, *Paederus zayasi*. Female eighth sternite and ninth (genital) segment. FIGURES 2-3, *Paederus spp*. Female eighth sternite. FIGURES 4-6, *Paederus spp*. Aedeagus from dorsal view. FIGURES 7-9, *Paederus spp*. Aedeagus from lateral view.

5. removal of *sublaevis* Sahlberg from the *vermiculosus* group (subgenus *Lyperopherus*) to a group of its own. I agree with changes 1-4, but feel a bit doubtful about the fifth. The eastern *moestus* group (subgenus *Refonia* Casey) is correctly retained as distinct from the *melanarius* group. In 1960 I suggested that the two groups be combined.

The genera *Calathus* (six species), *Pristonychus* (two species), *Synuchus* (two species), *Olisthopus* (two species) and *Atranus* (one species) require no special comment. Although the genus is not treated in the text, Lindroth states that *Anchonoderus* is an agonine. This is probably correct, but we need to know more about the tropical American agonines and lachnophorines before we can be sure of the taxonomic position of *Anchonoderus.*

In Canada and Alaska, the genus *Agonum* is represented by 71 species, and an additional 15 United States species are treated in the text and/or in the key. The species are arranged in 21 groups, of which 10 are Holarctic. The *sulcatus* group (subgenus *Tanystola*) was not treated because of insufficient material. The groups are not as clear-cut as are those of *Pterostichus*, and Lindroth states that: "The groups here proposed were erected mainly for practical purposes." Nevertheless, I think that in general the intra-group relationships are closer than the inter-group relationships. Hence, the species groups are phylogenetically "natural"ones. About the only "splitting" one might be tempted to do is to remove the *larvale* group (subgenus *Rhadine*) from *Agonum*, and treat it as a distinct genus. Thirteen of the groups of *Agonum* were first recognized and named as genera or subgenera by Casey, and it seems that he was more successful in recognizing groups of supraspecific rank than in recognizing those of specific rank.

The species included by Casey in the subgenus *Stictanchus* are placed in two groups which, according to Lindroth, are not closely related: the *bicolor* and *extensicolle* groups. The species of the former group are generally northern in distribution whereas those of the latter group are generally southern. The *albipes* group is represented in North America by one introduced species, *Agonum albipes* Fabricius.

Two new species of *Agonum* are described, both members of the *sordens* group (subgenus *Europhilus*), a notoriously "difficult" collection of species, which Lindroth revised in 1955, bringing order out of total chaos.

The key to the species of *Agonum* is good, but in spite of this it is extremely difficult to determine to species specimens of the *melanarium* group on the basis of the characteristics given. Lindroth (p. 599) recommends that characteristics of the male genitalia be used as a basis for making determinations, and I agree with him. There are two minor errors in this key, to be corrected as follows: couplet 8, add 9 after "(fig. 295 a, b)"; couplet 77, after "transverse meshes", change "77" to 78.

As a source of diagnostic characteristics, the male genitalia in *Agonum* are of widely varying value. It is possible to distinguish some groups of species on the basis of genitalic characteristcs. Within the *melanarium* group, the sculpture and form of the median lobe are diagnostic of species; in the *sordens* group and several others, the male genitalia are almost uniform. In the species *tenuicolle* LeConte, the armature of the internal sac is highly variable.

Turning to matters zoogeographical, it is interesting to note the approximate numerical equality of the northern agonines and pterostichines: in number of genera; in the total number of species of Agonum and Pterostichus; and in the number of species groups of Agonum and Pterostichus. On the other hand, the agonines, as a group, are predominantly hygrophilous, though not completely so, and the pterostichines as a group are predominantly mesophilous, though not completely so. Further to the south, the agonines are predominant in all habitats, and the pterostichines are scarce or absent. The species groups of Pterostichus are clearly defined, while those of Agonum are not so clearly defined. More groups of Pterostichus are represented on the tundra by more species than are the groups of Agonum. All of this seems to support Darlington's view that the agonines are a younger, expanding group, dominant in the tropics, while the pterostichines are an older lineage, giving way before the advance of the agonines, and in the process of becoming climate-limited. The point I want to make here is that it is now possible to undertake a zoogeographical analysis of the Nearctic species of this group of insects, something that could not be done previously because the species involved were so poorly understood.

This volume is an important part of a taxonomic masterpiece. As such, it can be studied with profit by anyone interested in publishing first-class taxonomic literature. For those interested especially in Carabidae, this work provides a firm foundation for revisions of all of the Nearctic species of the included groups. This publication is based upon a detailed knowledge of the Holarctic Carabidae and of the literature dealing with this group, and this information is presented clearly and simply. -- GEORGE E. BALL, Department of Entomology, University of Alberta, Edmonton, Alberta, Canada.

NEWS

INTERNATIONAL CONFERENCE ON SYSTEMATIC BIOLOGY was held at the University of Michigan, June 14-16; supported by the National Science Foundation, the feature speaker was Dr. Ernst Mayr: "The role of Systematics in Biology." The following Coleopterists were known to have attended the meeting as a part of the 450 registered: R. T. Allen (Carabidae, Loxandrus); R. H. Arnett, Jr. (Oedemeridae); E. C. Becker (Elateridae); R. E. Blackwelder (Staphylinidae); J. Bouseman (Rhipiphoridae); W. J. Brown (Chrysomelidae); L. P. Gibson (Curculionidae, Curculio); R. C. Graves (Carabidae and Cicindelidae); L. H. Herman, Jr. (Staphylinidae, Oxytelinae); T. F. Hlavac (Carabidae, Clivina); A. T. Howden (Curculionidae); H. F. Howden (Scarabaeidae); J. B. Karren (Chrysomelidae, Chlamisus); J. F. Lawrence (Ciidae); J. E. Lloyd (Lampyridae); R. B. Selander (Meloidae); P. J. Spangler (Hydrophilidae, Dytiscidae); W. R. Suter (Scymaenidae); J. Wagner (Pselaphidae); R. E. Woodruff (Scarabaeidae).

MELVILLE H. HATCH, Burke Museum, University of Washington reports that he is working on the last part, Part V, of the BEETLES OF THE PACIFIC NORTHWEST.

A second printing, slightly revised, of THE BEETLES OF THE UNITED STATES, by R. H. Arnett, is being prepared for the printer and will be published soon.

D. G. KISSINGER, Department of Biology, Atlantic Union College, South Lancaster, Mass. has received NSF support to continue and finish research on Apion of North America. When finished this will be published as a 500 page vol-

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Any article, note, or news item likely to be of interest to readers of the BULLETIN will be considered. Articles with illustrations are particularly desired, and in all cases, descriptions of new species must be illustrated. Descriptions of new species or genera MUST contain keys or be correlated with existing keys.

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ACSIP at Purdue University will provide xeroxed copies of original descriptions of North American Coleoptera, each description reproduced on a separate 8 1/2 x 11 sheet bearing the reference to the original description and other data. More information will be supplied upon request.

ume with about 150 pages of illustrations.

L. H. HERMAN, Jr. will join the staff of the AMERICAN MUSEUM OF NATURAL HISTORY, September 1, as a Coleopterist and assistant curator.

ERIC G. MATHEWS is spending most of 1967 and 1968 in Australia working on the comparative behavior and ecology of dung beetles. In this work he is supported by both Fulbright and Guggenheim Fellowships. His address is Division of Entomology, C.S.I.R.O., Box 109, Canberra, A.C.T., Australia.

CHARLES A. TRIPLEHORN reports that the Ohio State University has a vast amount of neotropical Coleoptera and other insects in the process of being sorted, mounted, and labelled. Most of the material is from Brazil, Honduras, Costa Rica, and Mexico and it is especially rich in aquatic beetles, scarabs, staphylinids, carabids, helodids, chrysomelids, cerambycids, and elaterids. He adds that anyone interested in studying any of these groups would certainly want to look at this material.

RONALD M. YOUNG, Department of Entomology, Purdue University, was awarded as Sigma Xi grant to assist him in his study of Polyphylla (Scarabaeidae) in North America. He is spending the summer collecting in Arizona.

HARVEY I. SCUDDER on January 1, 1967, became head of the Division of Biology and Health Sciences at California State College at Hayward, California. He retired after 20 years of active duty as a commissioned officer in the U. S. Public Health Service and is looking forward to working again with certain small families of small beetles.

H. E. BOMANS, 39, Ave. Charles Verhaegen, Crainhem, Belgium is preparing a partial revision of the Cladognathinae of Africa, the Lucanidae of Laos, and the Lucanidae of South East Asia.

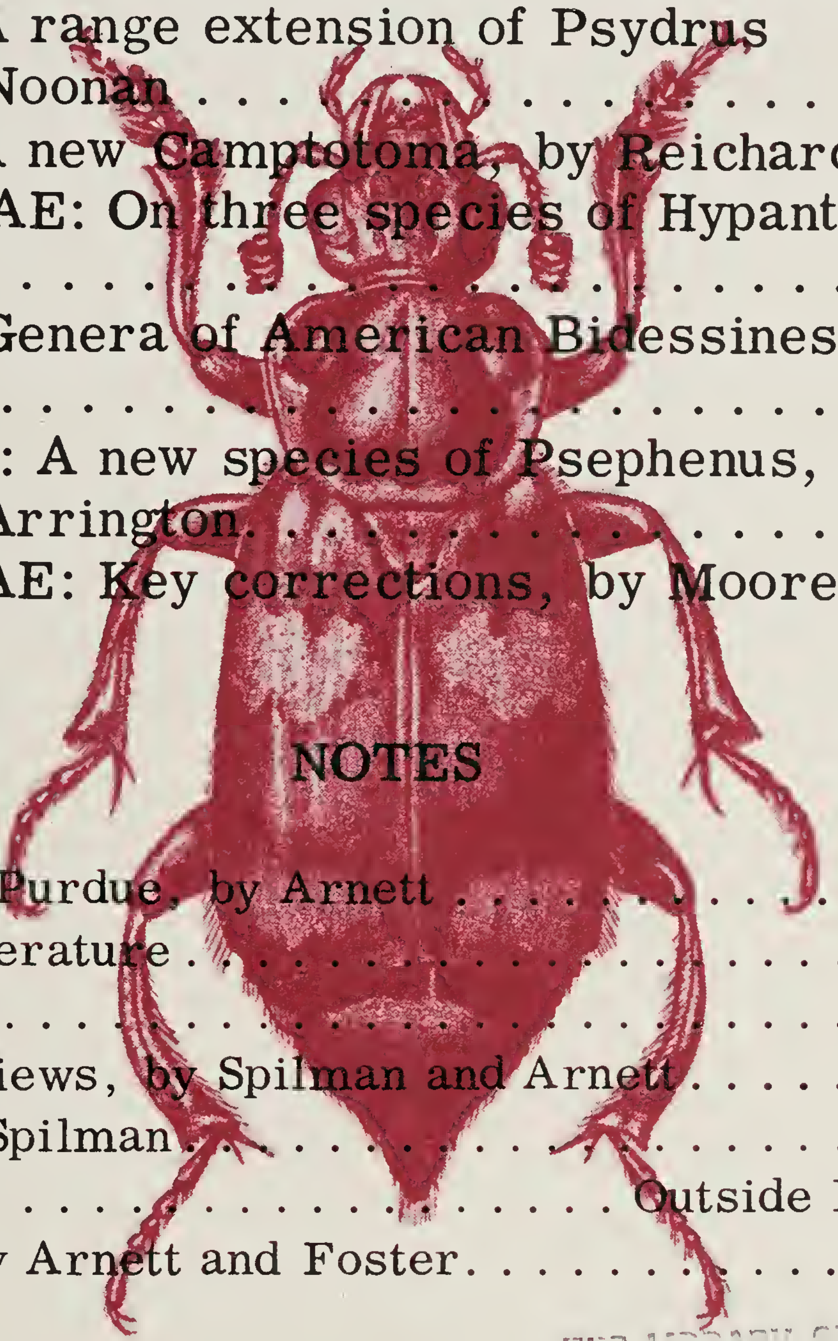
E. C. ZIMMERMAN, Hunter Farm, MacDowell Road, Peterborough, N. H. 03458 has recently completed sections of volume 9 of the Insects of Hawaii, Microlepidoptera. Next he will continue work on volume 14, Adephaga. He anticipates that his study of Hawaiian beetles will require 5 volumes. Also he continues to work actively on the Curculionidae of Polynesia, Melanesia, and Micronesia.

HARLEY P. BROWN, while on leave from the University of Oklahoma during the summer of 1966 spent two and one-half months collecting dryopids in Northern Mexico and south to central Panama.

SOUTH DAKOTA STATE UNIVERSITY insect collection contains specimens of many families and is available for study by interested taxonomists. The collection results mainly from the efforts of the late H. C. Severin and is being added to as rapidly as possible. The curator is Dr. E. U. BALSBAUGH, Jr., Department of Entomology, South Dakota State University, Brookings, South Dakota 57006.

ROBERT C. GRAVES, Department of Biology, Bowling Green State University, Bowling Green, Ohio 43402 has a collection of North American beetles from which he is willing to loan specimens for research purposes.

THE COLEOPTERISTS' BULLETIN



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THE COLEOPTERISTS' BULLETIN

VOLUME 21 SEPTEMBER 1967 NO. 3

ANTROFORCEPS, AN EYELESS CAVE SCARITINE FROM MEXICO (COLEOPTERA: CARABIDAE)[1]

THOMAS C. BARR, JR.[2, 3]

The large and widely distributed carabid tribe Scaritini has produced few cavernicolous species. In the temperate zone of North America scaritines are rare in caves even as accidentals I. Move (Barr, 1964), and Jeannel (1926) recorded no species of this tribe from caves of France. Leleup (1956) records only four species of scaritines in his collections of beetles in caves of the Congo, and all of these were reported as having been taken in the bottom of sinkholes or at cave entrances. Recently I have taken a few specimens of *Dyschirius* in Kentucky caves, and several species of *Clivina, Ardistomis,* and even *Schizogenius* have been collected in caves of Texas and Mexico by Mr. James R. Reddell. All of these scaritines apparently belong to normally epigean species found in the bottom of sinkholes or washed a relatively short distance into the caves by sinking streams.

The eyeless or microphthalmous scaritines of the genus *Reicheia* are small humicoles which appear to have originated in east-central Africa (Leleup, 1956) and dispersed southward to the Cape and northward to the Mediterranean region. The two known troglobites referable to the Scaritini—*Spelaeodytes mirabilis* (Miller, 1863) from an unspecified cave in Herzegowina and *Italodytes stammeri* (Müller, 1938) from a cave in Italy—are possibly relicts of one or two *Reicheia*-like ancestors (Jeannel, 1943: pp. 184-185). Both are extremely rare, *S. mirabilis* being known from a single specimen of uncertain provenance.

In November, 1966, Orion Knox, Jr., and Edward Alexander collected a small scaritine in the lower levels of the Sótano de la Joya de Salas, Tamaulipas, Mexico, incidental to exploration of the cave. The cave was reported to be considerably wetter than on previous visits made by these explorers and their associates. Mr. Reddell gave me the specimen for determination. The complete absence of eyes, the rufotestaceous integument, and the notable elongation of appendages indicate that this beetle is a troglobite, but it is somewhat larger and of a completely different habitus when compared with *Spelaeodytes, Italodytes,* and *Reicheia,* to which it almost certainly bears no very close relationship.

The known troglobitic carabids of Mexico are not numerous. *Mexaphaenops prietoi* (Bolívar, 1943) is a troglobitic trechine belonging to the *Paratrechus* series; it is known only from a single cave in Nuevo Leon. Three related troglobitic trechines from San Luis Potosí and Querétaro have recently come to my attention and will be described elsewhere. The recently discovered genus of cavernicolous anchomenines, *Mexisphodrus* (Barr, 1965, 1966; Hendrichs and Bolívar, 1966), includes 7 or more known species of which at least 5 are probable troglobites—*M. veraecrucis* from Veracruz, *M. profundus* from the Sótano de la Joya de Salas, and undescribed species from San Luis Potosí, Querétaro, and Oaxaca. Carabid troglobites, in common with troglobites of a number of other terrestrial arthropod groups in Mexico, occur predominantly in caves at elevations of about 1500 meters or higher.

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[1] This investigation was supported, in part, by a grant from the National Science Foundation (GB-5521).

[2] Department of Zoology, University of Kentucky, Lexington, Kentucky 40506.

[3] *Acknowledgments:* I wish to express my appreciation to Orion Knox, Jr., Edward Alexander, and James Reddell, for making available the specimen described in this paper; to P. J. Darlington, Jr., for loan of specimens of *Forcipator grandis* Perty, *F. cylindricus* Dejean, *Camptodontus crenatus* Brullé, and *Clivina forcipata* Putzeys from the Harvard University Museum of Comparative Zoology; and to Dr. Darlington and Mr. Donald R. Whitehead for other assistance in preparation of this paper.

Antroforceps Barr, NEW GENUS

Size moderately small (6.5 mm); elongate-subparallel, subconvex, integument rufotestaceous. Antenna with scape and pedicel subequal in length, pubescence beginning on 3rd segment. Eyes completely absent. Labrum with 5 setae on anterior margin; clypeus and frons fused, with no trace of a suture; frons with deep, wide, canaliculate grooves extending onto clypeus and occiput; one pair of clypeal setae and 2 pairs of supraorbital setae in the grooves. Mandibles slender, porrect, subfalcate; last segment of maxillary and labial palps fusiform, with apex produced, finely subtruncate; lacinia with apex acute; glossa elongate-triangular, bisetose, subequal in length to paraglossae; mentum tooth broad and spatulate, longer than lateral lobes. Pronotum elongate-subparallel, margins narrow and crenulate; 2 pairs of submarginal punctures; disc with a pair of antebasal, paramedian tubercles. Elytra convex, margins narrow and crenulate; disc with fine longitudinal striae, the 8th carinate at humerus and near apex, apically truncating all other striae except the sutural, scutellar stria absent; dorsolateral margin of last visible abdominal sternite without a rounded projection which fits between elytral plica and epipleuron; 3rd interval with 7-8 setiferous punctures near 3rd stria, each elytron with a non-setiferous scutellar puncture on a raised tubercle at base of 2nd and 3rd striae, umbilicate series uninterrupted and consisting of numerous punctures with short, irregular setae. Profemur only 1¼ times as wide as mesofemur; protibia "palmate," with 4 external spurs increasing in length toward apex; mesotibia with external subapical spur; metatibia arcuate; first tarsal segment longer than distal 4 segments combined; segments 2, 3, and 4 of pro- and mesotarsus transverse. TYPE SPECIES: *A. bolivari* Barr, new species.

Antroforceps bolivari Barr, NEW SPECIES

Figure 1

Length 6.5 mm. Elongate, subparallel, rufotestaceous; microsculpture uniformly isodiametric.

Head. Subquadrate, about as long as wide. Labrum with anterior margin convex, feebly umbonate, bearing 5 stiff setae on the margin—the seta at each corner very long—and 4 or 5 curved bristles at each corner. Clypeus weakly bisinuate, with a lateral tooth medial to each wing; clypeofrontal suture obsolete; one pair of clypeal setae. Frontal lobes rounded and prominent; frontal grooves deep, wide, and canaliculate, extending forward onto clypeus and backward onto occiput; 2 pairs of supraorbital setae placed far back, in occipital portion of these grooves; disc of frons between grooves smooth, feebly convex, glabrous; a narrow, carinate ridge forming outer wall of grooves in occipital region and separating them from genae; posterior region of fronto-occipital plate slightly but prominently elevated above neck. Eyes completely absent, sides of head beneath frontal lobes sunken; genae broadly expanded, anteriorly produced into a salient, flattened, triangular, postorbital tubercle on each side, with a second, much smaller tubercle behind. Head conspicuously constricted behind genae, neck less than 3/5 as wide as head measured across postorbital tubercles.

Thorax. Pronotum elongate-subparallel, 1 1/4 times as long as wide, disc feebly convex and glabrous; anterior angles prominent, anterior margin feebly convex; lateral margins narrow, beaded, irregularly crenulate in apical 2/3, with 2 prominent teeth near base; disc with a pair of small tubercles, one either side of mid-line near base; base not evidently margined before the peduncle; 2 pairs of marginal punctures which are not setiferous. Prosternum carinate in apical half; intercoxal process obliquely truncate, triangular, basolaterally forming a small tubercle at each side. Metepisternum 3 times as long as wide. Meso- and metacoxal cavities slightly separated.

Elytra. Elongate-elliptical, 1.9 times as long as wide (combined width), convex, disc medially deplanate over intervals 1-3 in basal 2/3; marginal bead distinctly and prominently crenulate, more strongly so than in pronotum; longitudinal striae fairly regular and well defined, especially inner 3 in area of deplanation; striae 4-7 feebly impressed and evanescently punctulate; 8th stria carinate, especially at humerus where it forms a prominent basal tubercle, and near apex, where it truncates all other striae except the sutural; 7-8 discal punctures on 3rd interval near 3rd stria; umbilicate series uninterrupted, with numerous punctures bearing short, irregular setae; scutellum not visible in the unique holotype; scutellar stria absent, although scutellar punctures, which are not setiferous, present on paramedian tubercles at base of 2nd and 3rd striae; epipleura without a subapical groove for reception of process from 6th sternite.

Mouthparts. Mandibles large, porrect, flattened, slender, subfalcate, 5/6 as long as head, terebra attenuate and gently curved inward, retinaculum with a small, broad tooth. Maxillary palps, labial palps, galea, and lacinia all elongate and slender; last segment of palps elongate-fusiform and produced at apex, very finely truncate; maxillary palps with last segment 2.6 times as long as penultimate; labial palps with last segment 1.6 times as long as penultimate segment, which is bisetose; lacinia sharply pointed and curved inward at apex, with a series of stout setae on inner margin. Glossa short, elongate-triangular in form, more or less acute at apex, bisetose; paraglossae slender and subequal in length to glossa. Mentum separated from submentum by a typical scaritine suture, slightly opened either side of midline, sensory organs readily visible through integument but not forming pits; mentum with a prominent, spatulate, broadly rounded tooth a little longer than lateral lobes, and with a median carina; one seta each side of carina near base of tooth, one seta at each side of mentum just anterior of suture, and one seta each side of submentum near its base. Gula narrow, 0.15-0.25 times as wide as mentum.

Antenna. Three-fifths as long as body; scape with a single subapical seta, pedicel plurisetose in apical half, articles 3-11 densely pubescent; scape about as long as pedicel, articles 2-10 elongate-subconical, article 11 elongate-fusiform.

Wings. Functional metathoracic wings absent.

Legs. All legs unusually elongate and slender. Protrochanter with a small tubercle at outer side of apex. Profemur not prominently enlarged as usual in scaritines, only 1 1/4 times as wide as mesofemur; protibia broad as usual, "palmate," with 4 external spines, apical spine longer than first tarsal segment, other spines decreasing in length toward base of tibia; apical and subapical spurs of moderate length, subequal. First segment of all tarsi longer than outer 4 segments combined; segments 2-4 of pro- and mesotarsi transverse, of metatarsi about as long as wide; segment 5 of all tarsi longer than wide; arolium flat, prominent, paddle-shaped; an arolium-like process arising each side of unguis, also flat and paddle-shaped. Mesotibia with a prominent, external, subapical apophysis and 2 inner apical spurs; numerous long setae on apical half. Metatibia slender, elongate, conspicuously arcuate, less than 0.4 as long as elytra, with 2 apical spurs and 8-9 long setae in apical half.

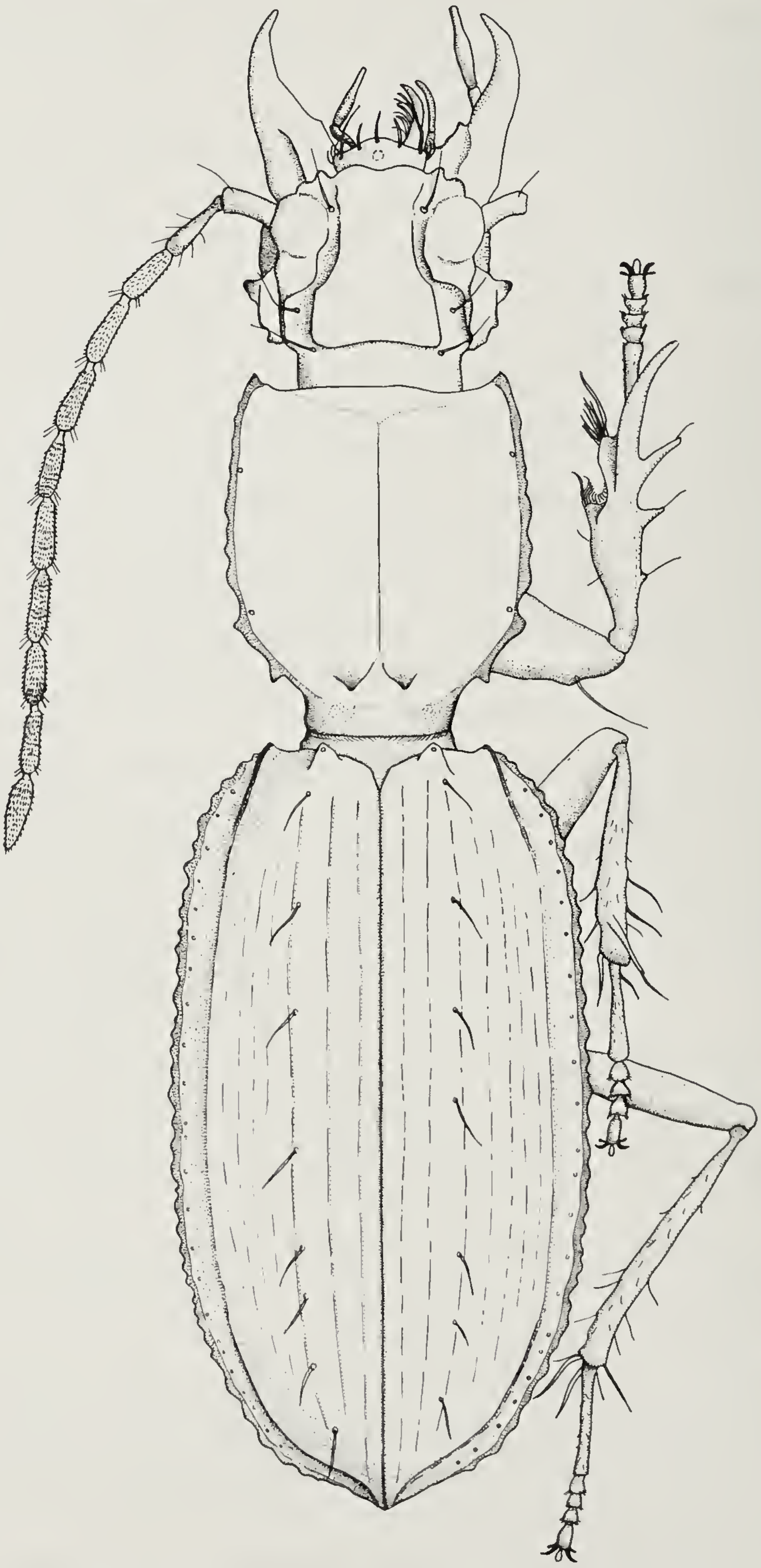

Figure 1. *Antroforceps bolivari* Barr, n. gen. and sp., holotype female, Sotano de la Joya de Salas, Tamaulipas, Mexico. Actual length 6.5 mm.

Abdomen. A pair of paramedian ambulatory setae on sternites 3-6 (female); 2 pairs of apical marginal setae on sternite 6 (female); a feebly impressed, transverse paralateral stria on sternites 4-6.

Male unknown.

Holotype female: total length 6.5 mm, head 0.99 mm long x 1.09 mm wide, pronotum 1.48 mm long x 1.22 mm wide, elytra 3.46 mm long x 1.82 mm wide (combined width), antenna 3.7 mm long, metatibia 1.32 mm long.

Type locality: Sótano de la Joya de Salas, elevation ca. 1600 meters, 25 kilometers west of Encino, Tamaulipas, Mexico, 28 November 1966, Orion Knox, Jr., and Edward Alexander, leg. Type deposited in Museum of Comparative Zoology, Harvard University.

It is a pleasure to name this remarkable species in honor of Dr. Candido Bolívar y Pieltain, Escuela de Ciencias Biológicas, Instituto Politechnico Nacional, México, D. F., a pioneer in the study of the cavernicolous Coleoptera of Mexico.

Discussion

The affinities of *Antroforceps* lie, in my opinion, with the scaritines of the subtribe Forcipatorina (= Oxystomina auct.). Five other genera of forcipatorines are known. *Oxygnathus* Dejean occurs in Bengal, Assam, and Burma. *Forcipator* Maindron (*Oxystomus* Latreille), *Stratiotes* Putzeys, *Camptodontus* Dejean, and *Camptidius* Putzeys are predominantly South American, although *Stratiotes iracunda* Putz. is recorded from Dominica and Martinique (Blackwelder, 1944), and *Camptodontus isthmius* Bates (1881: p. 30) was described from Panama. In this subtribe the genae are widely expanded behind the orbit, imparting a subquadrate appearance to the head, the clypeus is fused to the frons, and the mandibles are elongate and falciform.

Antroforceps differs from these five genera in absence of eyes, in having 5 setae on the anterior margin of the labrum, in the broadly sulcate head grooves, in the broader and flatter mandibles, in the crenulate margins of the pronotum and elytra, and in the generally slender and elongate antennae, mouthparts, and legs. Postorbital genal tubercles of the same shape and relative size as those of *Antroforceps* occur in *Forcipator,* in which the eyes are quite small and partly sunken into their orbits. The broadly sulcate head grooves of *Antroforceps* are probably derived by basal fusion of the frontal grooves with the grooves which separate the dorsum of the head from the genae and in which the supraorbital setae are placed. *Antroforceps* and *Oxygnathus* share elongate first tarsal segments and short 2nd, 3rd, and 4th segments as well as the subcarinate 8th elytral stria. The long exterior setae of the anterior margin of the labrum may be homologous with the 2 peripheral setae in *Oxygnathus,* in which the labrum is deeply emarginate. *Oxygnathus elongatus* Wiedemann has 6 setiferous punctures on the 3rd interval (Andrewes, 1929: pp. 341-342), while in *Antroforceps* there are 7 or 8. The prominent tuberculate scutellar puncture in *Antroforceps* has a possible precursor in *Camptodontus,* where the tubercle is very small and closer to the mid-line.

Antroforceps appears to be a most interesting relict, perhaps an archaic one. The present distribution of the Forcipatorina suggests colonization of South America in the early Tertiary, development of endemic South American genera during the subsequent long period of isolation, and virtual extinction of presumed geographical intermediates in eastern Asia, western North America, Mexico, and Central America. By this interpretation *Antroforceps* is the only known surviving representative of a phyletic line of scaritines otherwise extinct in North America north of Panama.

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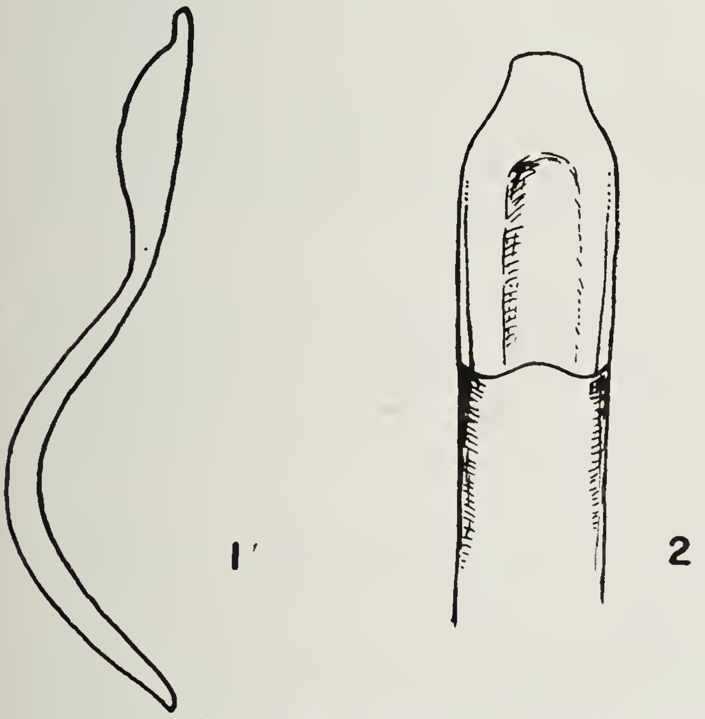
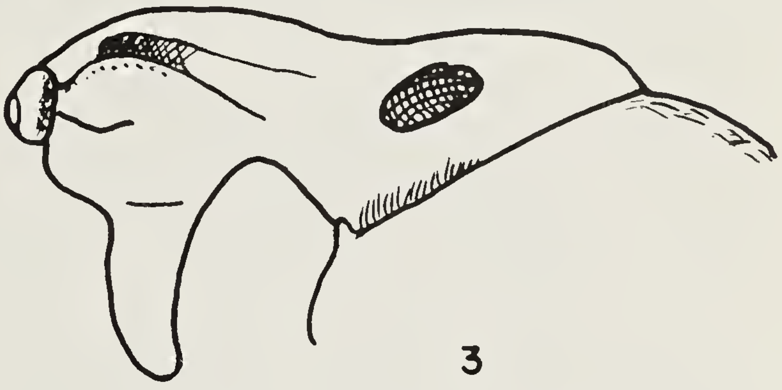
THE OTHER SEX OF THREE SPECIES OF HYPHANTUS KNOWN FROM ONE SEX ONLY, AND VARIOUS NOTES (COLEOPTERA: CURCULIONIDAE)

PATRICIA VAURIE[1]

The male of *Hyphantus incongruus*, an otiorhynchid weevil known from two females from Campos do Jordão, Sao Paulo, Brazil, has now been examined by me in the collection of Guillermo Kuschel, Division of Scientific and Industrial Research, Nelson, New Zealand. It is from Repreza Rio Grande, Sn. [=Sao] Bernardo, Sao Paulo, collected by B. Pohl in January, 1952, and differs notably from the females already described (Vaurie, 1963, p. 267) by having a subrostral tooth (the tip broken off, however), instead of a large tumidity, and the declivity of the elytra not furnished with two rows of four or five projecting tubercles at the suture. It differs further by being 7 mm. long instead of 9 mm., by having at the base of the beak dorsally two short lateral carinae as well as the short median carina, at the apex no trace of a V-shaped furrow, the elytra less acuminate apically, their humeri not at all prominent, the hairs among the tubercles evidently worn off. In my key to the species (*loc. cit.*, p. 256), the male would key out properly in couplet 31 if the words "of female" were added to "elytral declivity with slight tumidity on suture," and the words "male with subrostral tooth" were added also. This is the only species of the genus that lacks the tiny inner spine of the front femur as well as the V-shaped plaque on the dorsal apex of the beak. The aedeagus (fig. 1) is as sinuous in profile as that of *H. serpentis* Vaurie; in dorsal view the apex (fig. 2) is nearly like that of *carinatus* Vaurie (*loc. cit.*, p. 297, fig. 74), but without any carina.





FIGURES 1-2—*Hyphantus incongruus* Vaurie, aedeagus. 1—In profile. 2—Dorsal view of extreme apex.

FIGURE 3—Subrostral tooth of many males of *Hyphantus*.

Hyphantus chryseus Vaurie was described from the elytra and aedeagus of the type (state of Sao Paulo) and from a female paratype (Rio de Janeiro). An entire male has now been examined in the collection of Dr. Kuschel, also three additional females, all from Santa Mariana, Paraná, Brazil, collected by S. H. Nick, "1/15-12.49." The male has a large subrostral tooth as have the majority of males of the same species group (*maculifer* group), and the elytra are scarcely, if at all, wider than the pronotum. The aedeagus resembles that of the type specimen. The key to the species needs no change for this species.

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Hyphantus hypercalus Vaurie was known from two males from Brazil with no specific locality. In the collection of Dr. Kuschel are a male and female from Rio de Janeiro, Muri, collected by Wittmer on December 26, 1949. The female differs from the male only by having the elytra broader and the beak smooth below, without any tooth. No change in the key is needed for this species.

TAXONOMY, DISTRIBUTION, ECOLOGY

Hyphantus longicauda Vaurie. A startling reaffirmation is here recorded of the synonymy of *H. lanceolatus* Vaurie, described from three males, with *longicauda,* described from a female, by the examination of more than one hundred specimens of both sexes, some "in copula" from Sao Salvador, Rio Grande do Sul, Brazil. These specimens were sent me recently by Padre P. Buck, Museu Anchieta, Rio Grande do Sul, who collected them in September, 1965.

Hyphantus maculifer Desbrochers des Loges. No locality other than "Brazil" was given for this species, known from the unique male type. Two additional males in the collection of Dr. Kuschel do not add much to the exact distribution. One specimen has only the word "Boas" and a label "Collect. Plason"; the other is from Caraça, collected in 1884 by Germain, but there are three settlements of that name in eastern Brazil, in Paraiba, Baia, and Minas Gerais. These specimens have narrower elytra than those of the type, but the distinctive aedeagus with its sinuous sides is the same.

Hyphantus minutus Vaurie. Three of 12 specimens from Estaçao de Caldas, Minas Gerais, October, 1952, give one of the few ecological notes known for this genus of 36 species. The labels say "roendo brotas de Videia [=Videira ?]" chewing buds of grapevine. These specimens are in the collection of the Serviço de Defesa Sanitaria Vegetal at Guanabara, Rio de Janeiro, kindly sent me by Aristoteles Araujo e Silva.

Hyphantus montanus Vaurie. This species, known previously from many specimens from Serra Caraça, Minas Gerais, and nowhere else, may now be recorded from the city of Sao Paulo, as shown by a dissected male collected by Pohl in October, 1946, in the collection of Dr. Kuschel.

Hyphantus sulcifrons Boheman and *H. simulans* Vaurie. At the time of my revision (1963, p. 295) I had seen females of these two species from the same locality, but not males. In the collection of Dr. Kuschel there is a pair of *simulans* and a male of *sulcifrons* from Nova Teutonia, Santa Catarina, collected July 20, 1954, by Plaumann, and a male of each species from Serro Azul, Rio Grande do Sul. Twelve of the 19 males of *simulans* lack the characteristic spine within the hind tibia, a fact noted also in many previous specimens examined.

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A NEW CAMPTOTOMA FROM MINAS GERAIS, BRAZIL (COLEOPTERA, CARABIDAE)

HANS REICHARDT[1]

A recent paper by Nègre (1966) on the subtribe Chaetogenyina van Emden (Carabidae, Pterostichini), drew my attention to a series of small, very distinctive Pterostichini, which, after having been studied, turned out to belong to a new species of the genus *Camptotoma,* which Nègre removed from the tribe Anchonoderini and placed among the Pterostichini, Chaetogenyina. The three species treated by Nègre are from Colombia (one species) and Venezuela (two species). The species described below is the first one known from Brazil, having been collected in the northwest of the state of Minas Gerais by a field party of the Departmento de Zoologia led by P. E. Vanzolini. The Carabids collected on that trip seem worth being studied as a whole. Since such a task will take time, it seems best to publish the description of this new species separately.

Camptotoma flavostriata Reichardt, *new species*

(figs. 1-4)

TYPE DATA. *Brazil: Minas Gerais,* Arinos, Nov. 6-8, 1964 (holotype male, 2 males and 1 female paratypes); *Minas Gerais,* Buritis, Ribeirao Confins, Oct. 29-31, 1964 (1 male and 1 female paratypes). Holotype and 3 paratypes (1 male and 1 female from Arinos, 1 male from Buritis), in the Departamento de Zoologia, Sao Paulo; 1 male paratype from Arinos in the Museum of Comparative Zoology, Cambridge, United States; 1 female paratype from Buritis in the Muséum National d'Histoire Naturelle, Paris, France.

DESCRIPTION Very similar in size, color and shape to the other species of the genus; testaceous stripe on elytra, even though somewhat variable in the type-series, limited to a single (seventh) interstice. Head not punctured, very finely reticulated; labrum and palpi yellow, mandibles dark-brown; antennae yellow, somewhat darkened from the fifth segment on; each segment, except scape, with a ring of bristles at apex. Pronotum very cordiform, convex, very finely reticulated on surface, disc unpunctured; base with very strong and deep punctures; median sulcus well developed; lateral edges yellow anteriorly. Scutellum triangular, smooth. Elytra deeply punctate-sulcate in anterior half, sulcate in posterior half (9 sulci on each elytron); interstices convex, very finely reticulated; yellow stripe in most specimens running from humeri to about three quarters of total length of elytra; apex of third and fifth interstices also shortly yellow; in one specimen the stripe of the seventh interstice is fused, at apex of elytra, to the yellow apex of the fifth and third interstices, forming a continuous stripe; the stripe is always restricted to a single interstice; apex of elytra also yellow. Ventral side black, smooth; legs yellow, with darkened knees; front tarsi of males with thickened segments (fig. 3). Aedeagus (fig. 2) very similar to that of the other species of the genus. Measurements: length, 7.7-8.4 mm; humeral width, 3.2-3.4 mm.

TAXONOMIC DISCUSSION

Camptotoma flavostriata Reichardt, n. sp., the first species of the genus to be found in Brazil, seems to be more closely related to *marcuzzii* Nègre, recently described from Venezuela. The new species, however, has the yellow stripe restricted to a single, seventh, interstice, and has the base of the pronotum very strongly and deeply punctured.

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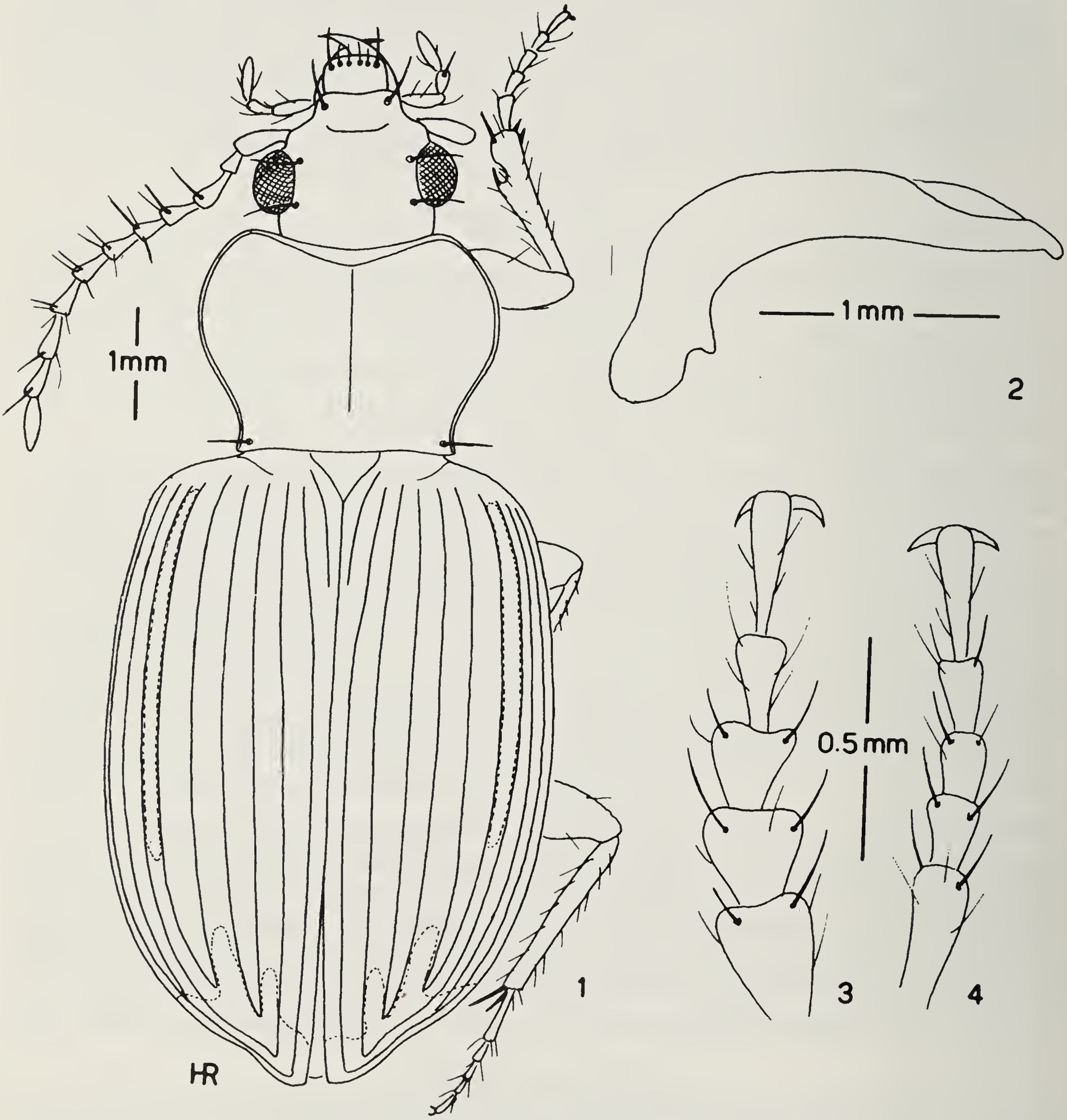
The key below, adapted from Nègre (1966), easily separates the four species presently included in the genus:

1. Pronotum only slightly wider than head, with rugose disc .... **LEBASI** Reiche
   Pronotum much wider than head, with smooth disc 2
2. Elytra covered with very short pilosity (visible only from a certain angle) .... **FREYI** Nègre
   Elytra completely glabrous 3
3. Sixth and seventh interstices yellow .... **MARCUZZII** Nègre
   Only seventh interstice yellow .... **FLAVOSTRIATA**, n. sp.



FIGURES 1-4. *Camptotoma flavostriata*, new species. 1—dorsal view of ♀ from Arinos. 2—aedeagus of paratype from Arinos. 3—front tarsus of male. 4—front tarsus of female.

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A KEY TO THE GENERA OF AMERICAN BIDESSINE WATER BEETLES, WITH DESCRIPTIONS OF THREE NEW GENERA

(Coleoptera: Dytiscidae, Hydroporinae)[1]

Frank N. Young

The many tiny species of the tribe Bidessini (Dytiscidae, Hydroporinae) are in great need of revision. At present, however, the group is in such a confused state and the faunas of great areas of the world are so poorly known that any revisionary work must be considered preliminary.

The following key largely based on notes made by the writer while a Guggenheim Fellow at the British Museum (Natural History) in London, is presented in the hope that it may encourage further collecting and study of this interesting group of aquatic insects.

In the American literature many species are placed in the genus *Bidessus* Sharp (1882), but this name actually covers a group of genera some of which are extremely different from typical *Bidessus*. Much of the difficulty lies in the small size of the insects (1.2 to 3.5 mm. in length) which makes their study difficult. In some groups the male genitalia have proven to be of great value in separating species and show excellent correlation with some generic groups.

The Bidessini and Pachydrini are associated by the fusion of the coxal plates to the abdominal sternites so that the under surface of the body from the front of the metasternum to the hind border of the third abdominal segment consists of one rigid piece. This is seen in typical form in all the American genera except *Hydrodessus*. In the Bidessini, however, the middle coxae are not separated by the intercoxal process of the metasternum which does not reach the metasternal fork and the posterior tibiae are slender, usually curved at the base and expanded toward the apex so that they appear club-like. The coxal lines are generally distinct and longer than the prosternal process. In the Bidessini, Pachydrini, and Hyphydrini the articular cavities of the hind coxae are not contiguous and not protected by the coxal processes so they open on the under surface of the coxae and are separated by the coxal processes which are usually adpressed to the level of the abdominal sternites (Sharp, 1882). The Bidessini thus form a distinctive group of hydroporine dytiscids although some genera show modifications of the tarsi not characteristic of the subfamily Hydroporinae. The many species show varying ecological modifications, and the group as a whole occupies the very small aquatic predator niche in the marginal zone and psammon of freshwater.

The characters which have been used for the separation of genera are not all of equal value or reliability. In the following key, I have attempted to evaluate these characters by placing emphasis on those which seem least subject to variation or differences in interpretation, but I have included summaries of other characters for the purpose of comparison. The key may be used in simplified form (à le Guignot) by ignoring all except the capitalized words or phrases.

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[1] Contribution No. 798 from the Zoological Laboratories of Indiana University, aided by grants from the U. S. Public Health Service and National Science Foundation.

Key to American Genera of Bidessini

1. HEAD WITH A TRANSVERSE CERVICAL STRIA OR SUTURE BEHIND THE EYES........ 2
HEAD WITHOUT A CERVICAL STRIA........ 9

2. PRONOTUM WITH IMPRESSED STRIAE AT THE BASE ON EITHER SIDE OF MIDDLE (and often with corresponding striae on bases of elytra)........ 3

PRONOTUM AND ELYTRA WITHOUT IMPRESSED OR INCISED STRIAE (at most with vaguely impressed groups of punctures); CLYPEUS DISTINCTLY MARGINED, but not upturned in front; elytra with suture not thickened and without sutural striae; EPIPLEURA WITH A BASAL EXCAVATION LIMITED BEHIND BY A TRANSVERSE CARINA: prosternal process with apex elongate, oval, broadly margined, tip rounded; metasternal fork broad, shallow, with lateral margins continuous with those of middle coxal cavities, not grooved medially; inner lamella of hind coxa with a longitudinal median groove terminating at posterior edge of metasternum; coxal lines strongly divergent anteriorly; anterior and middle tarsi pseudotetramerous, the 3rd segment distinctly bilobed; male genitalia with parameres complex, jointed and aedeagus simple; body form ovate to elongate oval and acuminate behind; dorsum moderately coarsely, regularly punctate; elytral markings fasciaform or lacking. South American species found in lenitic and lotic situations. (Genotype *Bidessus (Hemibidessus) conicus* Zimmermann, 1921)........
HEMIBIDESSUS Zimmermann

3. BASAL PRONOTAL AND ELYTRAL STRIAE DISTINCT, IMPRESSED OR INCISED (or pronotal stria seemingly continued by a distinct ridge or carina on the elytron)........ 4

PRONOTAL STRIAE DISTINCT, BUT ELYTRA WITHOUT BASAL, SUTURAL, OR ACCESSORY STRIAE, at most a basal stria vaguely indicated by a few impressed punctures; CLYPEUS THICKENED ANTERIORLY WITH TWO SMALL TUBERCLES AT MIDDLE; EPIPLEURA WITH A BASAL EXCAVATION LIMITED BEHIND BY AN OBLIQUE CARINA; prosternal process with apical portion margined, broader posteriorly than in front, not on same plane as metasternum, the tip bent (down) to make contact with the metasternal fork; metasternal fork broad, shallow, the lateral margins continuous with those of middle coxal cavities; inner lamella of hind coxae with narrow longitudinal median groove terminating at posterior edge of metasternum; coxal lines strongly divergent, then recurved before reaching edge of metasternum; anterior and middle coxae pseudotetramerous, 3rd segment bilobed; male genitalia with parameres simple, elongate, unjointed and aedeagus moderately modified; body form ovate, somewhat flattened, acuminate behind; surface highly polished; elytra without pattern, usually yellowish brown to dark red brown. South American species with some extending into the Antilles, Florida, and Mexico. (Genotype *Hyphydrus acuminatus* Steinheil, 1869) .... BRACHYVATUS Zimmermann, 1919.

4. CLYPEAL MARGIN THICKENED ANTERIORLY, UPTURNED, TUBERCULATE, OR DISTINCTLY RIMMED 5
CLYPEAL MARGIN NOT THICKENED OR ONLY FEEBLY SO, NOT MARGINED, UPTURNED, TUBERCULATE, OR RIMMED .. 6

5. BASAL PRONOTAL STRIAE CONNECTED BY AN IRREGULAR TRANSVERSE GROOVE; elytral stria seemingly extended onto disk of elytra as a distinct ridge or carina; ELYTRA WITH SUTURE NOT THICKENED AND WITHOUT SUTURAL STRIAE; CLYPEAL MARGIN THICKENED, TRUNCATE, UPTURNED WITH TWO SEPARATED TUBERCLES; epipleura simply excavated; PROSTERNAL PROCESS WITH APICAL PORTION IN NEARLY SAME PLANE AS METASTERNUM, ELONGATE, NARROW, DISTINCTLY MARGINED AND MEDIALLY GROOVED, FEEBLY ACUMINATE; METASTERNAL FORK BROAD, MARGINED ANTERIORLY, WITH LATERAL MARGINS CONTINUOUS WITH THOSE OF MIDDLE COXAL CAVITIES, BUT ALSO BIFURCATE AND EXTENDED POSTERIORLY ON THE MID-METASTERNUM ABOUT ⅓ DISTANCE TO COXAE BEFORE BEING LOST IN THE COARSE PUNCTATION; inner lamella of hind coxae with coarse punctures between the coxal lines obscuring median groove; coxal lines strongly divergent anteriorly; male genitalia with parameres broad, jointed and aedeagus complexly beaked or shaped like a bird's head; body form broadly ovate; elytra and venter with very coarse, sometimes confluent punctures; elytral pattern fasciate-maculate. South American, Antillean, Mexican, Central American, and southern United States species found in the sand margins of standing or running water. (Genotype *Anodocheilus maculatus* Babington, 1841) .... ANODOCHEILUS Babington, 1841

BASAL PRONOTAL STRIAE DISTINCT, BUT AREA BETWEEN THEM ESSENTIALLY FLAT; elytral striae distinct and in some species seemingly extended onto the disk as an irregular ridge; ELYTRAL SUTURE THICKENED WITH PUNCTURES FORMING A MORE OR LESS DISTINCT SUTURAL STRIA OUTSIDE THE THICKENING; CLYPEUS WITH ANTERIOR EDGE UPTURNED, PROJECTING IN FRONT, ALWAYS FORMING A DISTINCT ANGLE WITH UPPER AND LOWER SURFACES AND USUALLY FORMING A DISTINCT RIM; epipleura with a distinct basal excavation, but without a distinct transverse carina behind; PROSTERNAL PROCESS WITH APICAL PORTION NOT ON SAME PLANE AS METASTERNUM, ELONGATE, NARROW, MARGINED WITH A MEDIAL GROOVE, THE TIP MODERATELY ACUTE AND BENT (DOWN) TO MAKE CONTACT WITH METASTERNAL FORK; METASTERNAL FORK RATHER NARROW, LATERAL MARGINS CONTINUOUS WITH THOSE OF MIDDLE COXAL CAVITIES AND FEEBLY BIFURCATING TO EXTEND POSTERIORLY ON MID-METASTERNUM (OR

METASTERNAL FORK WITH SHALLOW MEDIAN GROOVE EXTENDING ABOUT ⅓ DISTANCE TO COXAL MARGIN); inner lamella of hind coxae with a shallow median groove extending to posterior edge of metasternum (or nearly flat with only a vague median groove); coxal lines sharply incised, moderately to strongly divergent anteriorly; anterior and middle tarsi pseudotetramerous, 3rd segment distinctly bilobed; male genitalia with parameres simple, jointed and aedeagus simple; body form ovate, usually strongly convex; surface smooth, finely or coarsely, but sparsely punctuate or matte with close fine punctures (latter condition usually associated with elytral ridges or suggestion of plicae); elytral color pattern fasciate, maculate, or reduced. Species of the western United States and northern Mexico extending into Central America mainly in lotic situations in the mountain regions. (Genotype *Hydroporus plicipennis* Crotch, 1873)..................
NEOCLYPEODYTES n. genus

6. TARSI CLEARLY 5-SEGMENTED, THE 4TH SHORT BUT NOT CONCEALED BY LOBES OF 3RD SEGMENT; MALE AND FEMALE DIMORPHIC, MALE WITH VENTER CONCAVE AND MIDDLE TIBIAE CURVED FOR CLASPING FEMALE; basal pronotal and elytral striae distinct, often deeply impressed; elytra with suture feebly thickened, but without indication of sutural striae or accessory striae; epipleura with base excavated, but without a transverse carina; prosternal process with apical portion curved, not on same plane with metasternum, elongate, oval, feebly margined, the tip moderately acuminate; metasternal fork narrow, curving (down) to meet apex of prosternal process (particularly in males), strongly margined laterally with margins bifurcating and continuing on mid-metasternum and curving outward to join coxal lines so that a distinct ventral platform is formed; inner lamella of hind coxae with longitudinal median groove extending onto metasternum; coxal lines parallel or slightly converging anteriorly; male genitalia with parameres complex, jointed and aedeagus elaborately modified suggesting in outline a boot or an extended leg with shoe; body form elongate, pronotum and elytra moderately discontinuous; surface often distinctly hairy and elytra irridescent, particularly in females; elytral color pattern often indistinct, fasciate. South American, Antillean, Central American, Mexican, and eastern United States species usually found in lenitic situations. (Genotype *Bidessonotus obtusatus* Régimbart, 1895)........
BIDESSONOTUS Régimbart, 1895.

TARSI PSEUDOTETRAMEROUS, THE 4TH SEGMENT CONCEALED IN THE LOBES OF THE 3RD; body form elongate, oval, pronotum and elytra usually continuous so outline from above is regular 7

7. APICAL PORTION OF PROSTERNAL PROCESS ELONGATE, NARROW, DISTINCTLY MARGINED, MEDIALLY CHANNELED; NOT STRONGLY ACUMINATE; COXAL LINES DIVERGENT ANTERIORLY; COXAL PROCESSES (POSTCOXAL LAMINA) NOT STRONGLY INCISED AT MIDDLE........................ 8

APICAL PORTION OF PROSTERNAL PROCESS TRIANGULAR (SPEAR SHAPED), ACUMINATE BEHIND, NOT MARGINED OR CHANNELED, FEEBLY CONCAVE AND PUBESCENT; COXAL LINES PARALLEL OR FEEBLY DIVERGENT ANTERIORLY; COXAL PROCESSES TRIANGULARLY INCISED AT MIDDLE; THE LATERAL LOBES ROUNDED AND CLOSELY ADPRESSED AND FUSED TO VENTRITE; anterior and middle tarsi pseudotetramerous, but 3rd segment not strongly bilobed; PROTIBAL SETAE STRONG, OVERLAPPING TARSI IN REPOSE; body form ovate, pronotum and elytra continuous; dorsum highly polished, moderately coarsely but sparsely punctate; elytral color pattern fasciate (Cervical stria present; basal pronotal and elytral striae distinct; no elytral sutural or accessory striae; clypeus feebly thickened anteriorly, not margined, front slightly impressed on either side of middle; metasternal fork narrow, lateral margins not bifurcate, continuous with margins of middle coxal cavities; epipleura with basal excavation, but no transverse carina behind; inner lamella of hind coxae with median groove ending at posterior edge of metasternum; anal sternite narrow, impressed at sides). A single South American species of unknown habitat. (Genotype *Bidessus atomarius* Sharp, 1882)..MICRODESSUS, n. genus

8. Basal pronotal and elytral striae distinct, rarely elytral striae reduced so that they are present only on the very base; ELYTRA WITH SUTURAL STRIAE LACKING AND WITHOUT ACCESSORY DISCAL STRIAE OF IMPRESSED PUNCTURES; ANAL STERNITE NARROW, IMPRESSED ON EITHER SIDE; male genitalia with parameres simple, slender, jointed and aedeagus simple; body form elongate oval to broadly oval; elytral color pattern usually fasciate, marbled, or reduced. North and South American species differing from Old World *Bidessus* primarily in lack of a distinct sutural stria on elytra. Distributed from Alaska to Patagonia. (Genotype *Hydroporus affinis* Say, 1823)..............................LIODESSUS Guignot, 1939

Basal pronotal and elytral striae distinct, but elytral stria usually short; ELYTRA WITHOUT SUTURAL STRIAE BUT WITH DISTINCT ACCESSORY STRIAE OF IMPRESSED PUNCTURES BETWEEN SUTURE AND BASAL STRIAE; ANAL STERNITE BROAD, NOT IMPRESSED AT SIDES; male genitalia with parameres simple, slender, jointed but aedeagus often complexly modified; body form elongate oval, often somewhat obtuse anteriorly and posteriorly; elytral color pattern lineate, sometimes obfuscated. (Cervical stria distinct; clypeus feebly thickened anteriorly, not margined; epipleura with basal excavation but no transverse carina behind; venter much as in *Bidessus* and *Liodessus*). South and Central American and Mexican species, with a few species in the southern United States. (Genotype *Hydroporus pullus* LeConte, 1855)............ NEOBIDESSUS n. genus

9. BASAL PRONOTAL AND ELYTRAL AND ELYTRAL SUTURAL STRIAE LACKING, AT MOST REPRESENTED BY A FEW

IMPRESSED PUNCTURES; MALE GENITALIA WITH PARAMERES SIMPLE, ELONGATE, UNJOINTED 10

AT LEAST BASAL PRONOTAL STRIAE PRESENT 11

10. METASTERNAL FORK WITH LATERAL MARGINS BIFURCATE, EXTENDING BACK ALONG MID-METASTERNUM AND SOMETIMES DISTINCTLY RECURVING TO MEET THE INCISED COXAL LINES TO DIFFERENTIATE A DISTINCT VENTRAL PLATFORM; (VENTRAL PLATFORM DISTINCT, BUT MARGIN NOT ALWAYS COMPLETE); COXAL LINES PARALLEL OR FEEBLY DIVERGENT ANTERIORLY; anterior and middle tarsi pseudotetramerous, 3rd segment distinctly bilobed; male genitalia with parameres simple, slender, unjointed and aedeagus simple; body form elongate oval, often strongly constricted between pronotum and elytra so outline is very discontinuous; elytral color pattern fasciate; (Prosternal process variable, sometimes with apex broad, unmargined, flattened, with tip rounded, sometimes narrow, elongate, strongly margined, and deeply grooved with tip moderately acuminate; clypeus simple or feebly thickened, not margined; epipleura deeply excavate at base without transverse carina; some species with an accessory lateral carina on base of elytra above the epipleura; inner lamella of hind coxa with narrow median, longitudinal groove extending onto metasternum, sometimes extending to metasternal fork; dorsum variably punctate). A complex of rare South American species usually found in the margins of lotic situations. (Genotype *Hydrodessus siolii* J. Balfour-Browne, 1953) ....
HYDRODESSUS J. Balfour-Browne, 1953
(Including *Brinkius* Guignot, 1957)

METASTERNAL FORK WITH LATERAL MARGINS CONTINUOUS WITH THOSE OF MIDDLE COXAL CAVITIES, NOT BIFURCATE AND NOT EXTENDING BACK ON MID-METASTERNUM; NO VENTRAL PLATFORM; COXAL LINES SLIGHTLY DIVERGENT ANTERIORLY; anterior and middle tarsi pseudotetramerous, but 3rd segment feebly bilobed; male genitalia with parameres simple, unjointed, but aedeagus sometimes complex, double; body form ovate, constricted between pronotum and elytra; ELYTRAL COLOR PATTERN OF DISTINCT DARK LINES RESEMBLING HIEROGLYPHICS ON A LIGHT YELLOW OR BROWN BACKGROUND; (Prosternal process with apical portion irregularly triangular (spear-shaped), broadly and irregularly margined, medially concave, moderately acuminate behind; clypeus feebly thickened anteriorly without distinct margin, feebly tuberculate over antennae in some species; epipleura with base excavated, but no transverse carina behind; inner lamella of hind coxae with narrow, medial, longitudinal groove extending onto metasternum; dorsum finely and evenly punctate). South American species found principally in the margins of lotic situations. (Genotype *Bidessus cruciatus* Régimbart, 1903) ....
HYPODESSUS, Guignot, 1939
(Including *Brachybidessus* Gschwendtner, 1954)

11. BASAL PRONOTAL AND ELYTRAL STRIAE PRESENT; ANTERIOR AND MIDDLE TARSI WITH 4TH SEGMENT SMALL, BUT 3RD SEGMENT FEEBLY BILOBED; male genitalia with parameres simple, slender, jointed and aedeagus simple or complexly modified........ 12

BASAL PRONOTAL STRIAE USUALLY DISTINCT, BUT ELYTRA WITHOUT BASAL, SUTURAL, OR ACCESSORY STRIAE; ANTERIOR AND MIDDLE TARSI PSEUDOTETRAMEROUS, 3RD SEGMENT STRONGLY BILOBED; male genitalia with parameres broad or complex and jointed and aedeagus simple........ 13

12. EYES PRESENT, WELL-DEVELOPED, PIGMENTED; BODY PIGMENT WELL-DEVELOPED; ELYTRAL COLOR PATTERN FASCIATE OR MARBLED; elytra with or without impressed sutural striae; metathoracic wings normal in most species, but reduced or lacking in some; elytra usually smooth, but sometimes with elongate setae, hairy; venter much as in *Bidessus* and *Liodessus,* but metasternal fork may be grooved anteriorly in some species; body form ovate or elongate oval, pronotum and elytra usually continuous; male genitalia with parameres simple, slender, jointed and aedeagus simple or complexly modified. Many African species and a number in the eastern United States and northern Mexico extending into Central America and possibly South America. (Genotype *Hydroporus lacustris* Say, 1823)............
UVARUS Guignot, 1939

EYES LACKING, NOT PIGMENTED; BODY PIGMENT AND COLOR PATTERN REDUCED; elytra with sutural stria of impressed punctures; metathoracic wings reduced, strap-like; venter, body form, and other structures much as in *Uvarus.* A single cavernicolous species from Venezuela. (Genotype *Trogloguignotus concii* Sanfilippo, 1958)
TROGLOGUIGNOTUS Sanfilippo, 1958

13. BASAL PRONOTAL STRIAE USUALLY DISTINCT, DEEPLY IMPRESSED, BUT SOMETIMES REDUCED, ALWAYS CONNECTED BY AN IRREGULAR TRANSVERSE GROOVE; clypeus thickened but not margined; epipleura with basal excavation, but without transverse carina behind; prosternal process with apical portion elongate, rather broad, coarsely margined, medially concave or channeled, with a peculiar medial extension which contacts metasternal fork; metasternal fork with lateral margins bifurcate, extending backward on midmetasternum, and sometimes vaguely extending to join the coxal lines and form a rough ventral platform; inner lamella of hind coxae with a median longitudinal groove extending onto metasternum; coxal processes barely passing a line drawn between the coxal lobes, not closely adpressed to ventrite but apparently fused with it; coxal lines moderately divergent anteriorly; male genitalia with parameres broad at base and with apex much as in *Hydroporus,* aedeagus simple; body form broadly ovate, very convex, pronotum and elytra moderately discontinuous; dorsal punctation usually coarse and regular; elytral color pattern variable, usually fasciate or reduced.

South American species of unknown habitat. (Genotype *Amarodytes percosioides* Régimbart, 1900)................AMARODYTES Régimbart, 1900

BASAL PRONOTAL STRIAE FINE, SHARPLY INCISED, OBLIQUE, NOT CONNECTED BY A TRANSVERSE GROOVE; clypeus not thickened; epipleura shallowly excavated at base without transverse carina; prosternal process with apical portion broad, feebly concave and with margin indefinite, sides nearly parallel then tip abruptly acuminate; metasternal fork broad with lateral margins continuous with those of middle coxal cavities, not bifurcate or extending onto mid-metasternum, no ventral platform indicated; inner lamella of hind coxa with a narrow median longitudinal groove ending at posterior edge of metasternum; coxal lines nearly parallel; coxal processes extending beyond a line drawn between coxal lobes, but closely adpressed and fused to ventrite; male genitalia with parameres complex, jointed and aedeagus broad, but relatively simple; body form elongate oval, somewhat flattened, pronotum and elytra moderately discontinuous; dorsum finely punctate, elytra usually with numerous setae, hairy, irridescent as in *Bidessonotus* in both sexes; elytral color pattern reduced or fasciate. South and Central American species found in lenitic situations, but some possible living in bromeliads. (Genotype *Bidessodes semistriatus* Régimbart, 1900)........BIDESSODES Régimbart, 1900

RELATIONSHIPS OF THE AMERICAN GENERA OF BIDESSINI

The relationships of the American genera of Bidessini to each other and to the Old World genera is still largely a matter of conjecture. There has obviously been considerable convergence in these small beetles, and some of the genera may be more distantly related than their general morphology suggests.

The presence or absence of a cervical stria back of the eyes is a character of considerable importance as was emphasized by Guignot. Its presence brings together *Hemibidessus, Brachyvatus, Anodocheilus, Neoclypeodytes, Microdessus, Liodessus,* and *Neobidessus* in what appears to be a fairly natural group. *Bidessonotus,* however, is apparently an ancient and specialized group possibly related to some of the Australian Bidessines.

Liodessus and *Uvarus* are superficially very similar except for the lack of the cervical stria in the latter, but the genitalia suggest greater differences than the external characters. *Liodessus* differs from the Old World *Bidessus* (s. str.) primarily in the absence of a sutural stria. Guignot placed considerable emphasis on this character, but a sutural stria in *Hydroporus* and some other genera is adventitious occurring sometimes in females only and sometimes in only some members of a series of the same species from a single locality. Thus the differentiation of *Liodessus* from the Old World *Bidessus* (s. str.) on this character alone does not seem very satisfactory. However, a sutural stria is consistently present in African members of *Bidessus* (with one exception) and consistently absent in American species of *Liodessus* so that perhaps we can place more reliance on this character in this group.

Hemibidessus appears to be the most primitive of the American genera with a cervical stria. *Brachyvatus* is a specialized form whose relationships are somewhat obscured by its ecological adaptations to a special habitat. *Neoclypeodytes* appears to be close to the protobidessus stock and probably represents something like the stock from which both the Old World *Bidessus* (s. str.) and *Clypeodytes* Régimbart were evolved. *Anodocheilus* seems to be a New World derivative of *Neoclypeodytes* which has become specialized for life in sand at the edge of water. *Liodessus* is probably a direct derivative of the Old World *Bidessus* (s. str.), but *Neobidessus* seems to be more primitive and the accessory discal stria might be interpreted as a sutural stria widely separated from the suture. *Microdessus* is probably an offshoot of *Liodessus*.

The remaining genera characterized by the lack of a cervical stria do not appear to form a homogenous group. *Amarodytes* is seemingly primitive, and may derive separately from the *Hydroporus* stock. It is superficially closer to *Hemibidessus* than to *Uvarus*.

Hydrodessus and *Hypodessus* are separated from other American Bidessines by the unjointed parameres of the male genitalia and other characters. Both lack the typical pronotal and elytral striae so characteristic of most of the others. Balfour-Browne (1953) even hesitates to place *Hydrodessus* in the Bidessini. The sum total of characters in both these genera, however, seems to point to their being specialized forms which differentiated early in the evolution of the group.

Hydrodessus may, in the present concept, be complex. I have not been able to examine enough members of this complex to decide whether the differences in prosternal process and the accessory epipleural ridge should be considered of greater importance, or whether *Brinkius* of Guignot should be accorded recognition.

Uvarus and *Trogloguignotus* are obviously related to African species of *Uvarus*. In *Uvarus*, however, a sutural stria may be present in the American forms. It is adventitious in the genotype, but seems always to be present in *U. spretus* (Sharp) from Mexico although the latter is in other characters including the genitalia very close to the genotype, *U. lacustris* (Say). Other Mexican *Uvarus* also have a sutural stria. Following Guignot's concept we would have to place these in *Guignotus* Houlbert, but comparison of the genotype of that genus with the American species convinces me that the resemblances are superficial and the American species should be referred to *Uvarus* as here redefined.

Bidessodes is another genus apparently not closely related to any of the other American genera and probably represents an ancient and specialized group. It superficially resembles *Bidessonotus*, but is clearly not closely related.

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NOTICE

The Entomological Society of New South Wales was founded in 1862. Its magazine, the Transactions, lasted for only two volumes, 1866 and 1873. The Society ceased to function after that and for all practical purposes was succeeded by the Linnean Society of New South Wales. However, in 1953 a new society specializing in entomology was formed; it eventually took the name The Entomological Society of Australia (N. S. W.). The Society has recently begun publication of the Journal of the Entomological Society of Australia (N. S. W.). The periodical is primarily interested in general entomology (including taxonomy) and economic entomology, and naturally Coleoptera will take a large share of each issue; it is edited by C. E. Chadwick. Subscriptions should be addressed to the Society at P. O. Box 22, Five Dock, Sydney, New South Wales; the price of volume 1 (1964) is $ 2.00, of volume 2 (1965) and succeeding volumes is $ 3.00 (Australian dollars).

- T. J. Spilman

XYSTROPUS CALIFORNICUS (HORN), A QUESTIONABLE MEMBER OF THE UNITED STATES FAUNA (COLEOPTERA, ALLECULIDAE)

By James D. Marshall[1]

The species of *Xystropus* Solier are brilliantly metallic beetles, often golden-green to cupreous in coloration, and are unusually conspicuous when compared to the usual North American alleculid fauna. The only species of this genus ever recorded from the United States is briefly discussed below

Xystropus californicus Horn

Prostenus californicus Horn 1868: 138.
Xystropus californicus: Champion 1888: 470.
Xystropus fulgidus Mäklin 1875: 680.—Champion 1888: 464.

In addition to the conspicuous coloration, typical of the genus, *Xystropus californicus* (Horn) also has unusually coarse, very uneven punctation on the head and thorax. No other form of alleculid ever recorded from north of Mexico has this combination of characters.

This species was described by Horn on the basis of two specimens that were sent to him from Martinez, California. Horn himself expressed doubt as to whether they should be considered a part of the United States fauna. Champion (1888, p. 464) stated that the insect is very abundant in Panama, and on p. 570 he repeated Horn's suspicion in regard to the California record. He then went on to state that the species was not known to him from north of the Isthmus of Tehuantepec. Similar doubts were later expressed by Casey (1891) and Leng (1916).

Since 1961 the present writer has had the opportunity to examine thousands of alleculids from all over western United States, and it seems that almost a century of collecting has failed to affirm the occurrence of this conspicuous and beautifully colored beetle in California. It seems impossible that it could have escaped detection for so long. In view of this, the species should not be considered a member of the United States fauna, and should be dropped from lists and catalogs.

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A NEW SPECIES OF *PSEPHENUS* FROM MEXICO AND TEXAS (COLEOPTERA, DRYOPOIDEA, PSEPHENIDAE)

HARLEY P. BROWN[1] AND RICHARD ARRINGTON, JR.[2]

The Genus Psephenus is represented in the eastern and central portions of the United States and adjoining portions of Canada by a single species, *P. herricki* (Murvosh, 1960), and in the western states by five species: *P. lanei* in Idaho (Blaisdell, 1923); *P. calaveras, P. falli, P. haldemani,* and *P. veluticollis* in California (Casey, 1893; Leech and Chandler, 1963). A distribution map provided by Murvosh in 1962 also indicates records for western and northeastern Oregon and for the northwestern corner of Wyoming. Those in western Oregon are probably *P. haldemani.* Those in northeastern Oregon and the Yellowstone region may well be *P. lanei.* The western species apparently need study and possible revision. We have had access to none of them. In Mexico, the genus has been represented to date by *P. palpalis* and *P. usingeri* in the southcentral region (Hinton, 1934), and by *P. haldemani* in Baja California (Horn, 1870).

A population of *Psephenus* exists in southwestern Texas and in the Mexican states of Tamaulipas, Nuevo Leon and San Luis Potosi which constitutes a hitherto undescribed species. The description follows.

Psephenus texanus Brown and Arrington, NEW SPECIES

Male (Figs. 1, 2)—Oblong-oval, moderately depressed, densely pubescent, brown to black, moderately shining above, often with a greenish bronze sheen; antennae brown to black, the first two segments often lighter; maxillary palpi testaceous to black, the terminal segment usually darkest; coxae fuscous; femora fuscous dorsally, usually testaceous ventrally; tibiae usually dark, each with an apically expanding light testaceous streak on its anterolateral surface; tarsi testaceous to almost black, the terminal segment darkest; tarsal claws usually light proximally, dark apically. In many specimens, the head and pronotum are black, the elytra brown, and the lateral margins of the elytra and the posterior margins of the abdominal sternites are testaceous to fuscous.

Head transverse; densely, minutely punctate; rather deeply concave; anterior (clypeal) margin raised, forming a prominent, medially-emarginate flange; eyes prominent, hemispherical; antennae eleven-segmented and reaching to or slightly beyond base of elytra, the first segment longest, the third next longest, the fourth and eleventh subequal and almost as long as the third, the fifth to tenth subequal; maxillary palpi about half as long as antennae, the first segment short, the second about three times as long as the first, the third somewhat shorter than the second, and the fourth about the same as the second, but slightly enlarged and flattened, with a glabrous anterior margin; mandibles rudimentary, often visible only upon dissection; labial palpi inconspicuous, white-tipped.

Pronotum transverse, convex, about one-third wider than long; apex arcuate, about half as wide as base; apical angles broadly rounded; sides strongly convergent anteriorly; base bisinuate; basal angles obtusely rounded, turned slightly inward; disk evenly and moderately convex or with a slight median longitudinal carina in posterior half; densely and minutely punctate.

Elytra densely and minutely punctate; sides slightly explanate, subparallel, evenly arcuate in posterior third to form rounded, slightly divergent apices; basal humeri prominent; disk moderately convex, becoming less convex posteriorly; scutellum about as wide as long, rounded posteriorly.

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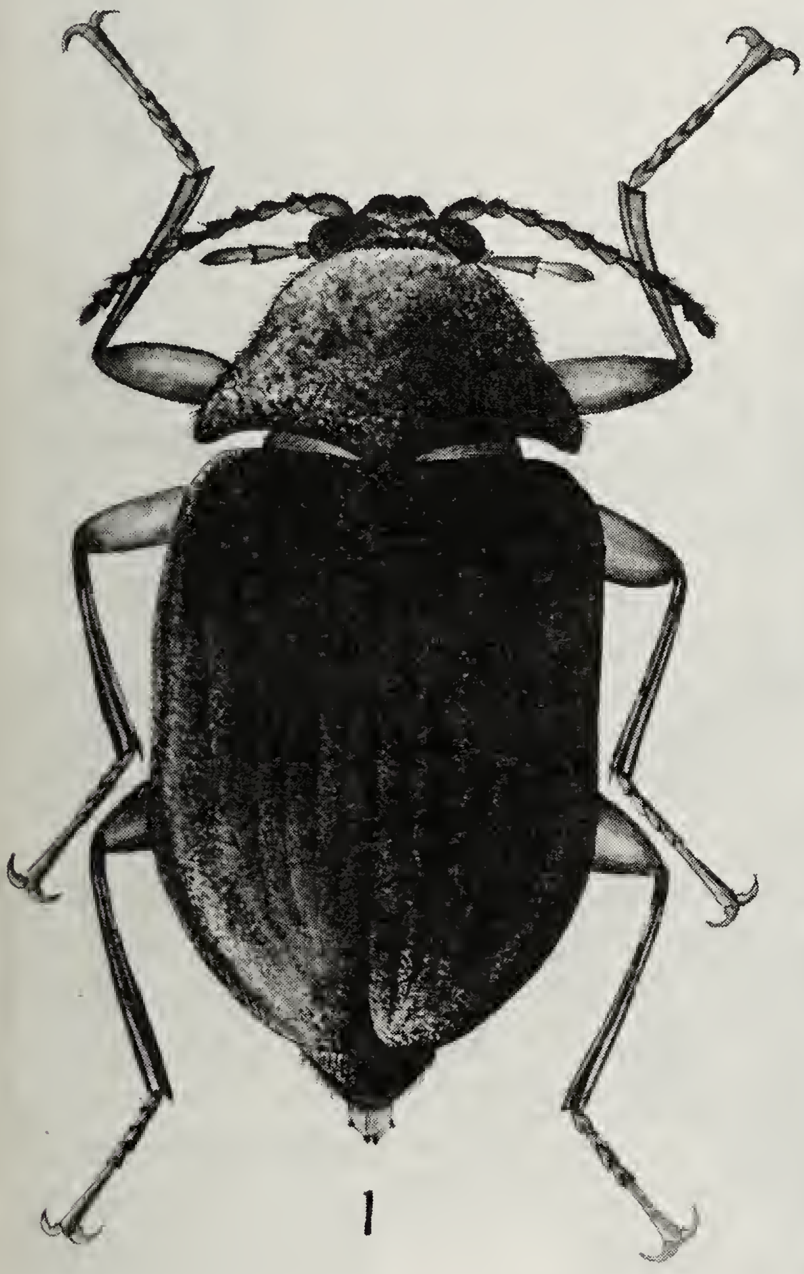
[2] Mr. Arrington's present address is: Miles College, Birmingham, Alabama.

Fifth ventral abdominal segment broadly, arcuately emarginate medially, exposing even more deeply emarginate sixth segment; seventh segment often clothed with conspicuous pale hairs directed posteriorly; similar hairs on mid-ventral portions of fourth and fifth segments of some specimens.

The male genitalia exhibit a V-shaped median spicule (Fig. 5).

Tibiae and tarsi slender. Tarsal claws feebly toothed at base.



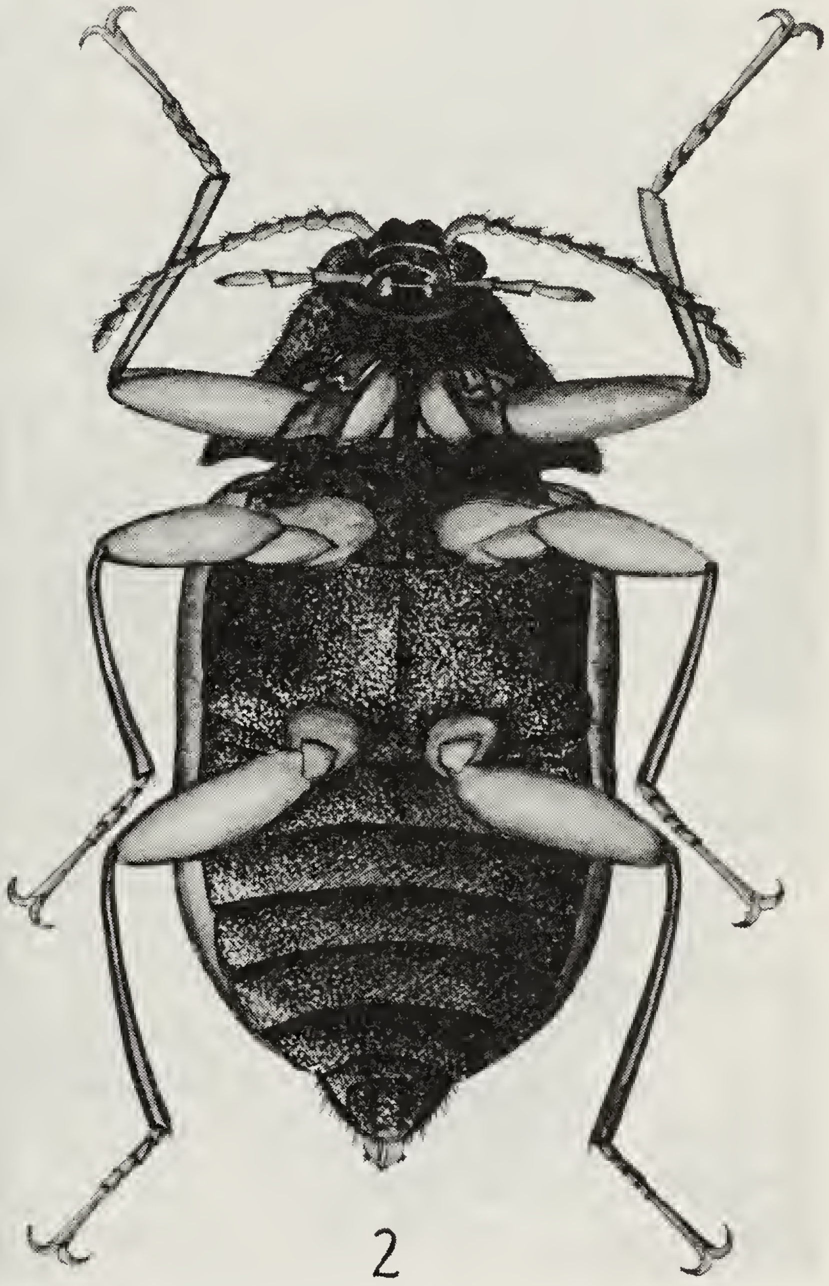


Figure 1. ***Psephenus texanus*** **n. sp. Male, dorsal aspect. Length 4.8 mm.**
Figure 2. ***Psephenus texanus*** **n. sp. Male, ventral aspect. Length 4.8 mm.**

Length 4.0-5.2 mm (type 4.9 mm); width across elytral humeri 1.7-2.4 mm (type 2.1 mm).

Female—Like male except as follows: antennae usually uniform in color; clypeal flange less prominent but with medial emargination noticeable; dorsal concavity of head shallower; antennae smaller, shorter, not quite reaching to base of elytra, less nearly serrate; maxillary palpi only about 2/5 the length of antennae; only 6 abdominal sternites visible, the fifth being arcuately, shallowly emarginate medially. These sexual differences are typical of the genus.

Length 4.5-5.3 mm; width across elytral humeri 2.0-2.6 mm; greatest elytral width 2.4-3.2 mm at about apical 3/5.

Holotype, male, in the Stovall Museum, University of Oklahoma, Norman. Type locality: San Felipe stream in Del Rio, Val Verde County, Texas, at an elevation of about 300 meters. Collected on October 3, 1964 by H. P. Brown and C. M. Shoemake. Paratypes: in the collection of H. P. Brown 7 males with same data as type (also 42 larvae); in the U. S. National Museum 6 males and 12 females (and 2 larvae) taken by F. C. Pratt at Kerrville, Texas 20 June 1907 and 1 male taken by Pratt at Devil's River, Texas 7 May 1907. Other specimens in the collection of H. P. Brown assigned to this species include: 3 larvae from Real Co., Texas; 1 adult from Uvalde Co., Texas; 6 adults, 254 pupae (the majority riddled by parasitic wasps; vide Brown, in press), 151 old "pupal shells" (carapaces of last larval instars beneath which pupation had occurred), and 345 larvae from the Rio Sabinas, Nuevo Leon, Mexico; 14 adults and 28 larvae from other localities in Nuevo Leon south of Monterrey; 2 adults, 53 larvae, and 3 old "pupal shells" from four rivers in Tamaulipas; 1 adult and 6 larvae from Rio Axtla south of Ciudad Valles, San Luis Potosi, Mexico. Elevations range from about 100 to 600 meters. Most of the streams contain travertine, which indicates a high calcium content in the water.

This species appears to be most closely related to *Psephenus herricki,* from which it differs most conspicuously in the appearance of the clypeus. When viewed in anterior aspect, the clypeus of *P. texanus* is much more prominent, the medial indentation being typically quite noticeable (Figs. 3, 4). This feature can be easily observed from above or below (Figs. 1, 2). Perhaps the genitalia provide even better distinguishing characteristics, the median penial spicule being V-shaped in *P. texanus,* whereas that of *P. herricki* is constricted between base and apex, and the base exhibits little if any indentation (Figs. 5, 6). More details of differences are presented in Arrington's dissertation (1966), in which *P. texanus* is referred to as "Species A" and is compared with *P. herricki, P. palpalis,* and *P. usingeri.*

The larva of *P. texanus* (Figs. 9, 10) is very much like that of *P. herricki* in appearance and behavior. During the day, larvae are found beneath stones in shallow, well-aerated, fast-flowing streams. In subdued light or darkness they move to the upper surfaces of the stones (beneath the water surface) to graze upon the encrusting algae, as described by West (1929). As larvae approach maturity, they tend to migrate to quieter water at the foot of a riffle or in pools between riffles, thence to the water's edge, then up among the damp stones to some suitable pupation site. The site selected may be anywhere from just above water level to several feet above water level. Most often the site is on a rather smooth surface on the under side of a stone, not in direct contact with soil. Clinging to the stone with its sharp claws, the larva appresses the edges of its flattened carapace to the substrate and becomes attached. Whether any secre-

LEGENDS FOR FIGURES

FIGURE 3. *Psephenus texanus* n. sp. Clypeus and labrum of male, anterior aspect. Clypeus stippled.

FIGURE 4. *Psephenus herricki.* Clypeus and labrum of male, anterior aspect. Clypeus stippled.

FIGURE 5. *Psephenus texanus* n. sp. Male genitalia, ventral aspect. Penial spicule stippled.

FIGURE 6. *Psephenus herricki.* Male genitalia, ventral aspect.

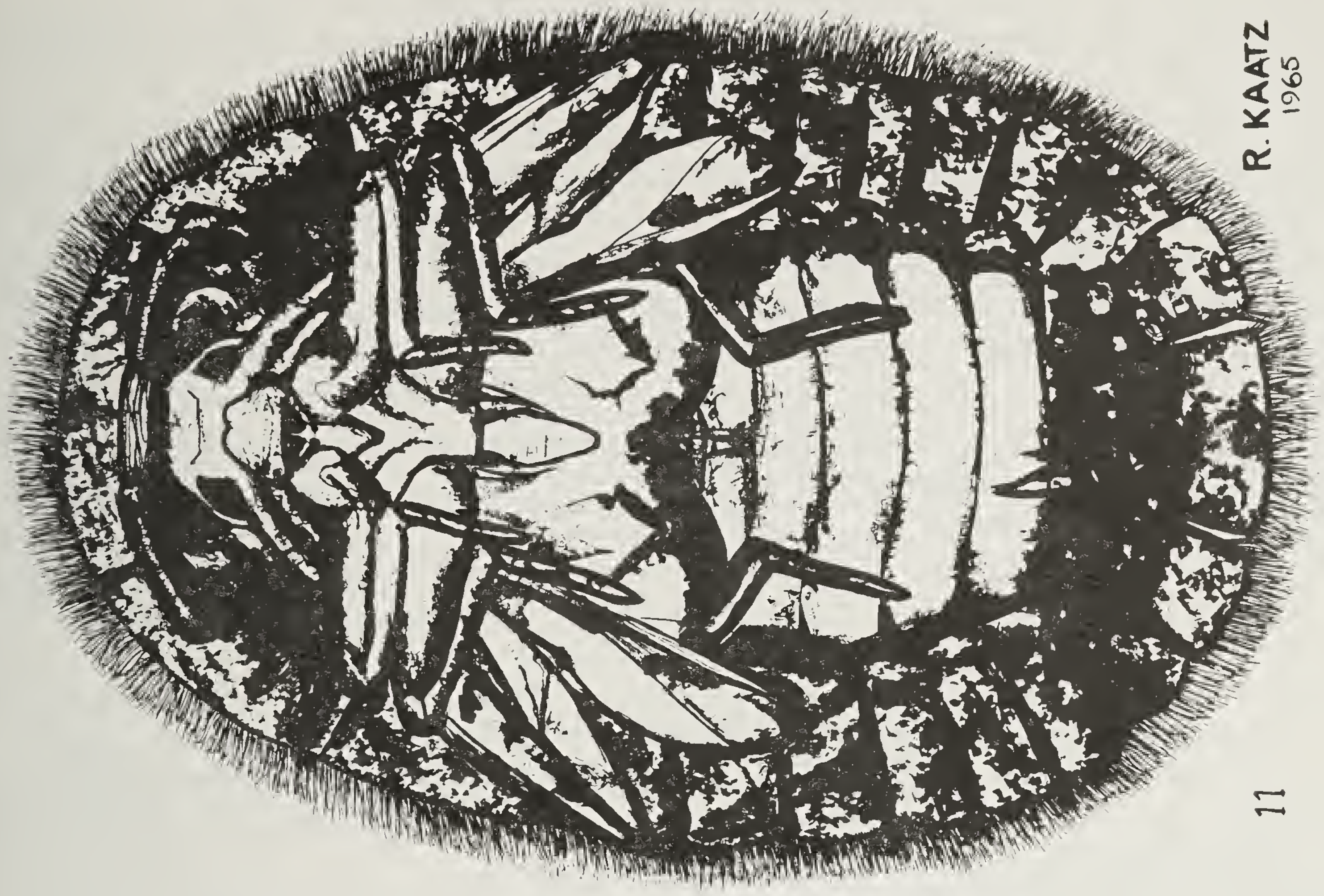
FIGURE 7. *Psephenus palpalis.* Male genitalia, ventral aspect.

FIGURE 8. *Psephenus usingeri.* Male genitalia, ventral aspect.

FIGURE 9. *Psephenus texanus* n. sp. Larva, dorsal aspect. Length 8.5 mm.

FIGURE 10. *Psephenus texanus* n. sp. Larva, ventral aspect. Length 8.5 mm.

FIGURE 11. *Psephenus texanus* n. sp. Pupa, ventral aspect, within last larval carapace. Length 8 mm.



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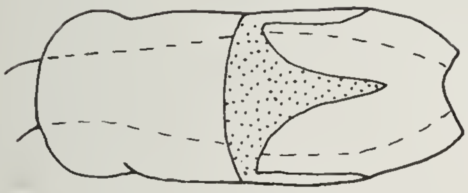

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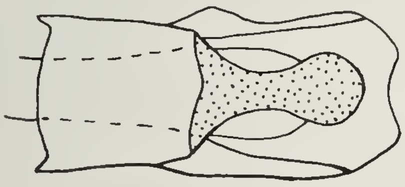

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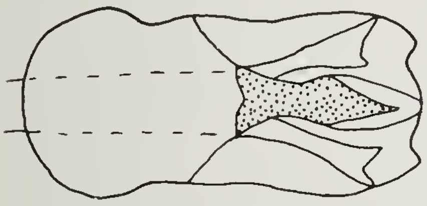

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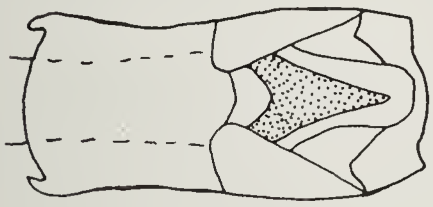

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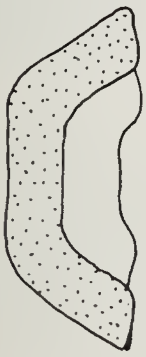

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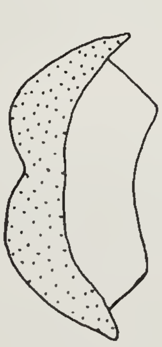

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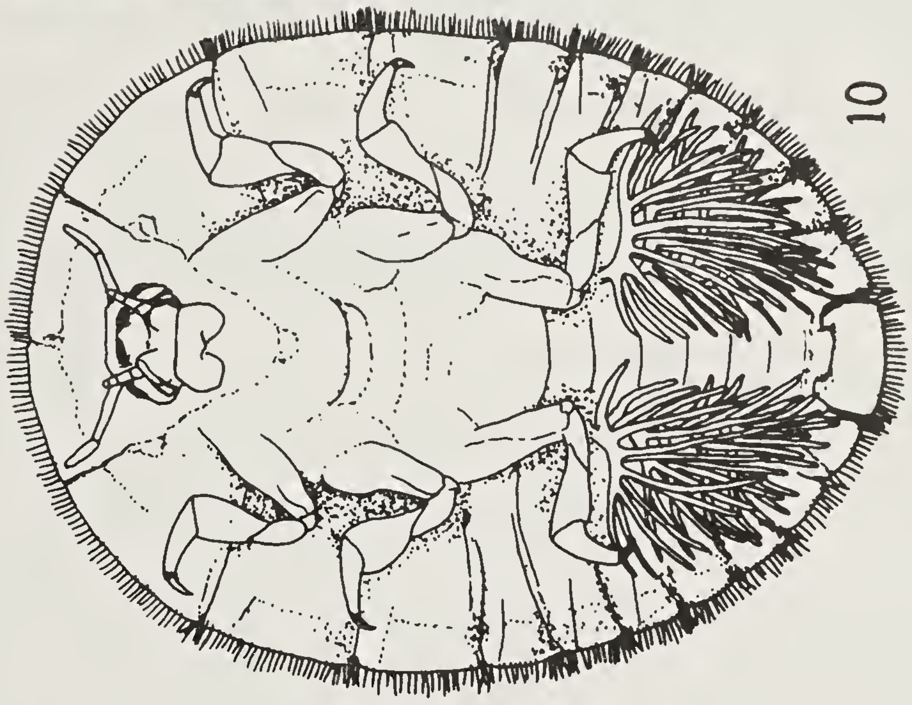

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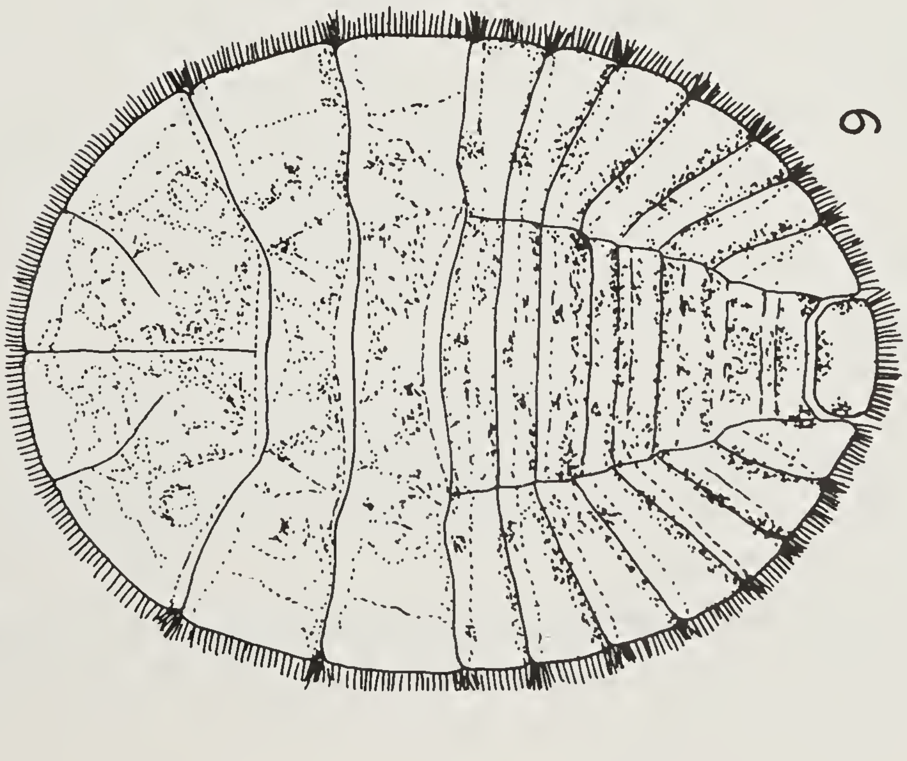

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tion is involved in attachment we do not know, but the attachment is quite firm. Perhaps the only cementing agent is mud which hardens when the peripheral fringe of hairs is flattened against the substrate.

We do not know how long the prepupal larva waits before ecdysis; however, within a day or two pupation commences, the pupa remaining beneath the larval carapace (Fig. 11). Of two migrating larvae collected on 15 Dec., one emerged as an adult male on 28 Dec., the other on 29 Dec. Thus, although we do not know the precise duration of the pupal stage, we know that it was less than two weeks. The adult escapes by raising an edge of the sheltering larval carapace.

Although our collections date only from October to mid-December, we suspect that all stages occur throughout the year in regions blessed by year-round mild temperatures. In the northernmost portion of its range, *P. texanus* probably overwinters in the larval stage, as does *P. herricki*.

The following key is, of necessity, based chiefly upon male specimens. Couplets 6-8 are taken from Leech and Chandler (1963), who suggest that couplet 6 may prove to concern a sexual character.

KEY TO NEARCTIC AND MEXICAN SPECIES OF *Psephenus*

1. Dorsal concavity of head divided by a median longitudinal ridge; California .... P. HALDEMANI Horn 1870
– Dorsal concavity of head not divided 2
2. Sides of pronotum strongly convergent, the apex not more than about half as wide as the base 3
– Sides of pronotum feebly convergent, the apex at least two thirds as wide as the base 6
3. Male: antennae reaching to base of elytra; clypeus and frons forming a prominent, medially emarginate flange which projects antero-dorsally (Figs. 1-3); median penial spicule V-shaped (Fig. 5); Texas, Neuvo Leon, and Tamaulipas .... P. TEXANUS Brown and Arrington NEW SPECIES
– Male: antennae not reaching elytra; clypeo-frontal flange, if present, not as above; median penial spicule not V-shaped 4
4. Male: maxillary palpi about half as long as antennae; second segment of maxillary palp not as long as third and fourth combined; Nova Scotia to Oklahoma .... P. HERRICKI (DeKay) 1844
– Male: maxillary palpi at least two thirds as long as antennae; second segment of maxillary palp usually longer than third and fourth combined; Mexico 5
5. Male: maxillary palp three quarters length of antenna; apex of median penial spicule enlarged and bluntly rounded (Fig. 7) .... P. PALPALIS Champion 1913
– Male: maxillary palp about two thirds length of antenna; apex of penial spicule acute (Fig. 8) .... P. USINGERI Hinton 1934
6. Pronotum velvety black 7
Pronotum dull and opaque, not velvety 8
7. Pronotal sides evenly and feebly arcuate from base to apex; pronotal punctures rather strong and dense anteriorly, becoming finer and sparse behind; California .... P. VELUTICOLLIS Casey 1893
– Pronotal sides straight or feebly sinuate in middle two-fourths, anteriorly arcuately continuous with the rounded apical angles, apex arcuate; la-

brum impressed at middle; pronotal punctures scarcely recognizable (female); California.......P. CALAVERAS Blaisdell 1923

8. Pronotal sides broadly rounded and subparallel toward base, more convergent and more nearly straight anteriorly, apex truncate; elytra with impressed lines, disc feebly elevated along the suture (male); southern California.......P. FALLI Casey 1893

– Pronotal sides broadly arcuate, somewhat broadly feebly sinuate at middle, apex arcuate; elytra without impressed lines, not elevated along suture in male; Idaho.......P. LANEI Blaisdell 1923

ACKNOWLEDGEMENTS

We express our appreciation to Miss Ramona Kaatz for Figs. 1, 2, 9, 10, and 11, to the University of Oklahoma for financial assistance through the Faculty Research Fund, and to Dr. Paul J. Spangler for the loan of specimens from the U. S. National Museum.

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CURRENT LITERATURE

Halffter, G. and Mathews, E. G., 1966. The Natural History of Dung Beetles of the subfamily Scarabaeinae (Coleoptera, Scarabaeidae). Folia Entomologica Mexicana, no. 12, 312 pp., 52 figs.

This book is a comprehensive summary of the biology of dung beetles including a review of the available literature, the incorporation of a great amount of original data, and a masterful synthesis of these facts to show evolutionary trends.

– R. H. Arnett, Jr.

On August 25, 1967, N. M. Downie observed large "colonies" of Gyrinidae on the surface of Grass Lake, St. Lawrence Co., New York. An interest in the composition of one of these associations lead him to select one for study. Collections were made from it by rowing a boat through the group. A small sieve was manipulated from the prow to capture the beetles as the boat went through the colony. About 10 such forays were made through the beetles each time after they had reassembled. Altogether over 200 specimens were taken.

An examination of the specimens revealed that they belonged to two genera and five species. The genus of larger water beetles, Dineutes MacLeay, was in a decided minority, these being only four specimens of D. assimilis Kby. in the catch. The most common species taken was Gyrinus ventralis Kby., there being more than 150 of these present. Next in order of frequency was G. frosti Fall, which accounted for about 60 specimens. Two other species, G. lugens LeC., and a small unidentified Gyrinus (about 4 mm.) were represented by 4 specimens each.

E. N. Kjellesvig-Waering of Port-of-Spain, Trinidad suggests the easiest method of collecting Cicindelidae is with an aerosol bomb (he finds "Real Kill" to be the best). Getting up-wind from the beetles, he sprays them, taking 50-100 specimens in a few minutes.

Many, if not most species of adult Oedemeridae are host specific, feeding on a great variety of plants. According to R. H. Arnett, few field records of these associations are available. Notes on this made when beating or sweeping will be of great value.

A RANGE EXTENSION OF *PSYDRUS PICEUS* LECONTE (COLEOPTERA: CARABIDAE) INTO SOUTHERN CALIFORNIA

Gerald R. Noonan[1]

The range of *Psydrus piceus* LeConte was formerly thought to extend only as far south as northern California. Ball (1963) had reported the beetle as being present from the forests of northern California to the Lake Superior region. Lindroth (1961) cited it as "Transamerican but rare and erratic in occurrence. S.[outh] to N.[orthern] Calif." It is now apparent that this species also occurs in southern California.

While routinely determining some Carabidae from southern California, I noticed six specimens of *Psydrus piceus*. Four of these were collected by Dr. E. L. Sleeper and Mrs. M. Y. Knox on February 1, 1959 at Brown's Flat, San Dimas Experimental Forest, San Gabriel Mountains, Los Angeles County. Dr. Sleeper informed me that the beetles were "found in passageways in a rotten pine log." The other two specimens of *Psydrus piceus* were collected by Mr. E. M. Fisher on May 15, 1965 at Poopout Hill, Barton Flats Recreational Area, San Bernardino Mountains, San Bernardino County. According to Mr. Fisher the beetles were taken by peeling bark off of fallen pine trees.

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[1] Long Beach California.

CORRECTIONS TO MY KEY TO THE SUBFAMILIES OF THE NEARCTIC STAPHYLINIDAE[1]

IAN MOORE[2]

An exception has been found to each half of couplet twelve of my key to the subfamilies of the Staphylinidae. Couplet twelve of the key attempted to distinguish members of the Euaesthetinae from members of a large number of other subfamilies on the basis of the segmentation of the tarsi. The first half of couplet twelve stated that the anterior tarsi were four-segmented in the Nearctic Euaesthetinae. However, in *Stictocranius* the anterior tarsi are five-segmented. The second half of couplet twelve, which stated "anterior tarsi five-segmented" led to seventeen other subfamilies including a large number of genera. Among these genera is *Thoracophorus* (subfamily Lispininae) in which the tarsi are three-segmented. Consequently, it is necessary to substitute another character.

The only consistent character known to me may be stated as follows:

12. First segment of maxillary palpi elongate, at least one-half as long as second .... EUAESTHETINAE
    First segment of maxillary palpi short, never more than one-third as long as second 13

It is unfortunate that this character is difficult to observe in many museum specimens.

The character of the elongate first segment of the maxillary palpi of members of the Euaesthinae is unusual among the Staphylinidae. A similar condition occurs only in members of the Steninae. In members of the latter subfamily, the condition is more pronounced, the basal segment of the maxillary palpi being as long as, or nearly as long, as the second.

Figure 3 in the same article is labeled *Pinophilus testaceus* Erichson, a *lapsus calami*. It should be labeled *Palaminus testaceus* Erichson.

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[1] Moore, Ian. 1964. A new key to the subfamilies of the Nearctic Staphylinidae and notes on their classification. Coleopt. Bull. 18:83-91, figs. 1-13.

[2] Research Associate in Entomology, San Diego Natural History Museum, San Diego, California.

FIREFLY REVIEWS

COLEOPTERORUM CATALOGUS SUPPLEMENTA. PARS 9 (EDITIO SECUNDA). LAMPYRIDAE. By. F. A. McDermott, 149 pp., 1966. Dr. W. Junk, Publishers, The Hague, Netherlands. (Price US $ 14.55)

Just how much was this new edition of the lampyrid catalogue needed? Ernest Olivier's first edition appeared in 1910 and McDermott's second edition cut-off date was the end of 1964. The first contained 1097 species and the second 1891 species. Thus, an astounding 42 percent of the presently known species were described in the last 55 years. The number of genera increased from 53 to 85, with 37 percent being described in 55 years. Add to those increases the many changes of status, combination, and nomenclature and anyone can see a definite need for a new list.

The catalogue follows the latest classifications. The genera are arranged in subfamilies, tribes, and subtribes. One subfamily, the Rhagophthalminae, is considered by some students to constitute a separate family. The drilids are not included; some workers would have made them a subfamily. A few new names necessitated by homonymies are proposed, and a few new combinations are introduced. Only three subspecies are recorded; that might be a record low for a beetle family of this size. The long list of references to biologies given in the first edition has been omitted, but many such references have been included under the individual species. It would seem that the lampyrids have gone the way of other experimental insects in that taxonomists can no longer be expected to include all references; so, references to luminosity and the structure of the luminous organs have been largely omitted.

This catalogue is up to the consistently high standards of previous Junk catalogues. Certainly Junk deserves much praise. So does Mr. McDermott; he worked very hard on this piece and did a fine job. But he is not here to read any words of just praise. He died on the day he received his copy of Pars 9. Not many men are so fortunate as to end a career with a magnum opus.

-- T. J. Spilman, U. S. Department of Agriculture, Washington, D. C.

STUDIES ON THE FLASH COMMUNICATION SYSTEM IN PHOTINUS FIREFLIES. By James E. Lloyd, 95 pp., 1966. Misc. Publ. Mus. Zool. Univ. Michigan, no. 130.

The remarkable and unique phenomenon of flash communication among fireflies was partially worked out by H. S. Barber, to the disbelief of many of his colleagues of that day. Lloyd and John Buck both have shown Barber to be absolutely correct and each has gone on to quantify this work.

No student of biology can consider himself educated until he is familiar with Lloyd's recent work. This is as fascinating and as basic as Von Frisch's studies on bee communication. (One of the most enjoyable evenings I have spent in the field was with Lloyd last March when I saw him demonstrate firefly communication and aggressive mimicry.)

This publication contains the results of several seasons work involving about 25 species of Photinus. Students of this group will want to study these data in detail. Others will benefit by a study of the author's methods and the treatment of the data gathered and discussed.

It should be noted that this work would not have been possible with Green's (1956) revision*. Lloyd would have had to name "patterns" and he would have been bogged down with names, literature, and specimens instead of doing the field work necessary to make these discoveries. This, I believe, is further proof of the benefits that will come about for biology as a whole as more and more groups are revised. -- R. H. Arnett, Jr.

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* Green, J. W., 1956. Proc. California Acad. Sci., 28: 561-613, 19 figs.

REVIEWS

EPIZOIC SYMBIOSIS. By J. L. Gressitt, J. Aoki, and G. A. Samuelson, 1966. Pacific Insects, 8: 221-297. WEEVIL GENUS PANTORHYTES. By J. L. Gressitt, 1966. Pacific Insects, 8: 915-965.

Only a few cases of epizoic symbiosis have been recorded previous to these papers. The sudden discovery of many species of beetles showing such an interesting phenomenon can only arouse suspicion that symbiosis of this sort is more widespread than previously believed.

Two Papean weevil genera, Gymnopholus (Leptopiinae) and Pantorhytes (Brachyderinae), are recorded as supporting on their elytra or pronotum growths of algae, fungi, lichens, and liverworts in which live mites, nematodes, rotifers, diatoms, and other microörganisms. So far, only 16 of the 47 species of Gymnopholus and 10 of the 60 species of Pantorhytes are known to support these plants, but Gressitt suspects there are more.

With the exception of the new orabatid mite, Symbionbates papuensis Aoki, the animal life found in these plants is named only to phylum; the cryptogramic plants are determined to family. Descriptions of new species (33 of Gymnopholus and 31 of Pantorhytes) are accompanied by keys to all of the species of each genus. A list of additional species exhibiting epizoic symbiosis includes a few genera from three other weevil subfamilies (Cryptorhynchinae, Otiorhynchinae, and Baridinae) and also the colydiid, Dryptops phytophorus, which Samuelson describes as a new species.

In addition to the taxonomic value of this work, these articles will surely stimulate further interest in symbiotic relationships between insects and plants and other animals. -- Janice C. Foster, Purdue University.

WHITE GRUBS AND THEIR ALLIES; A STUDY OF NORTH AMERICAN SCARABAEOID LARVAE. By Paul O. Ritcher, 1966. Studies in Entomology no. 4. Oregon State University Press, 219 pp. $ 10.00.

Students of the Scarabaeidae are very fortunate to have such a wealth of literature on their group. With the exception of the Cerambycidae, this family is probably the best known of the major families of North American beetles. There are, of course, several difficult groups that remain to be worked out, most of which are currently under study by one or more American Coleopterists. Outsiders look forward to the day when a comprehensive review of the family is made available under one cover.

Included in the studies on this family are many short papers on the larvae. Among the leading students of this stage of these insects is the very capable author of this book. Paul O. Ritcher has brought together a monographic treatment of the current knowledge available on scarab larvae, including his own extensive observations as well as those of his colleagues. The book is well printed and profusely illustrated with line cuts of the larvae and two plates of very fine photographs of adults, although the inclusion of the latter is somewhat of a surprise.

This book includes all of the subfamilies of Scarabaeidae except Ochodaeinae, the larvae of which are not known, and it also includes the families Lucanidae and Passalidae. The latter two families have not received the attention given to the scarabs. A quick comparison with the catalog of beetles shows that nearly one-half of the U. S. genera are included with representative species of each. The larger genera have only a small proportion of the species described, but in most cases, this is all that are known. In some genera, the author has wisely not attempted keys to all of the known species because of the intraspecific variation present.

The book shares in a common fault of many otherwise useful books, that of not being clear as to what is left out. The title is misleading because it implies that it includes Mexico in the area covered, although the introduction does refer the reader to additional papers to cover some of the omissions.

With this fine volume readily available at a moderate cost, is should be an easy matter for any interested person to collect, rear, and add to our knowledge of this very interesting group. This as a stimulus, it may well be that the book will be soon out of date, and that this will induce Paul Ritcher to enlarge the work and continue to provide us with such a fine product. -- R. H. Arnett, Jr.

ACSIP AT PURDUE

(Continued from p. 32.) New editor. - Reference to the inside back cover as well as to the masthead will show that the Bulletin once again has a new editor, the fourth in its history. Dr. N. M. Downie is not only a Cornell University trained entomologist, but has had a lifelong interest in collecting and identifying beetles. He is well known to many of our subscribers through his activities in identifying North American Coleoptera; others will now know him as he continues the development of our journal.

ACSIP. - You may have noted the announcement on the inside back cover of the (late) June issue of the Bulletin of the Purdue project of xeroxing the descriptions of North American Coleoptera. The xerox machine is installed and project is going forward. Arrangements have been made for the sale of the descriptions. Those available will be announced from time to time. We hope that all authors will automatically provide us with copies of their papers so that the new species and genera can be processed. These papers will be listed in the current literature section of the Bulletin. (To be continued.) - R. H. Arnett.

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OEDEMERIDAE: World revision now being completed: desire material for identification. R. H. Arnett, Jr., AMTRI, 550 Elston Road, Lafayette, Indiana 47905.

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THE COLEOPTERISTS' BULLETIN

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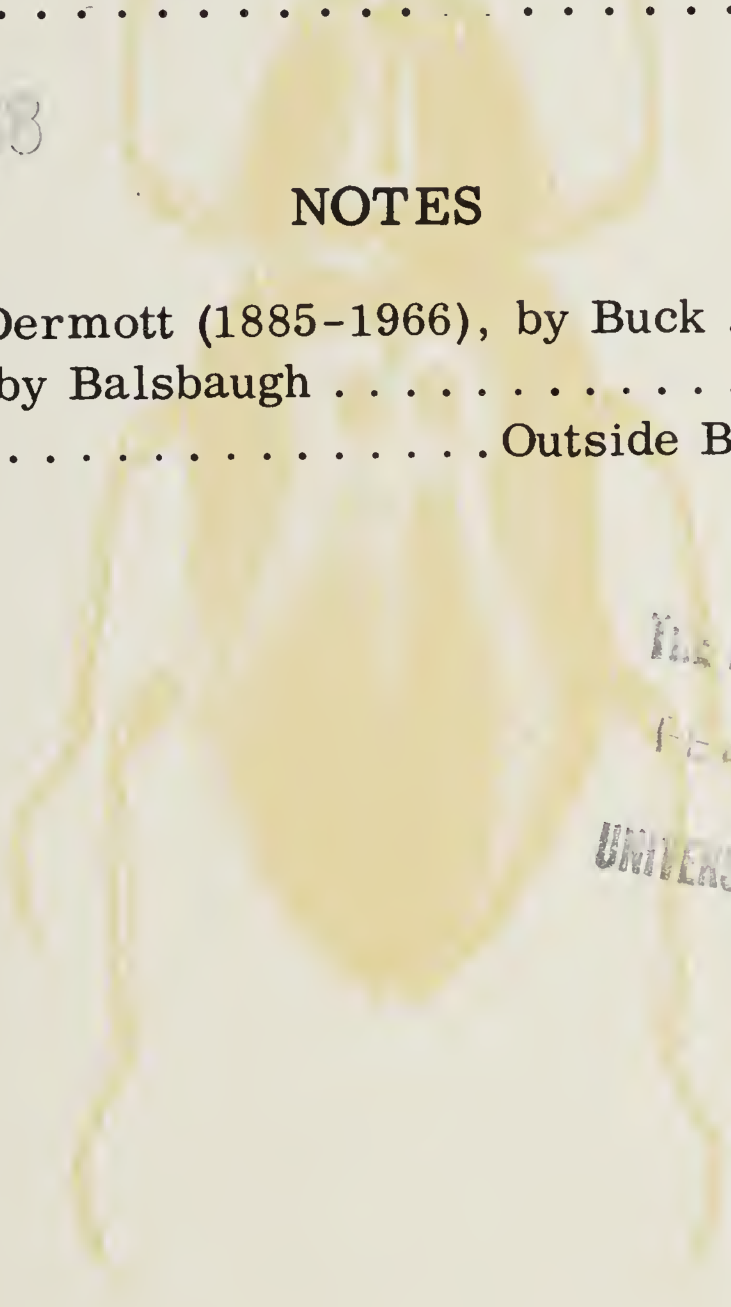

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THE COLEOPTERISTS' BULLETIN

Founded 1947 by Ross H. Arnett, Jr.

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THE COLEOPTERISTS' BULLETIN

VOLUME 21 DECEMBER 1967 NO. 4

THE IMMATURE STAGES OF *PHANAEUS (COPROPHANAEUS) JASIUS* OLIVER AND *PHANAEUS (METALLOPHANAEUS) SAPHIRINUS STURM* (COLEOPTERA: SCARABAEIDAE)

W. D. Edmonds[1]
University of Kansas

This paper describes and gives observations on the biology of the larva and pupa of *Phanaeus (Coprophanaeus) jasius* Oliver and the larva of *Phanaeus (Metallophanaeus) saphirinus* Sturm, two common South American dung beetles. Following the classification of Janssens (1949), most workers currently place *Phanaeus* and related genera in the subtribe Phanaeina, one of four subtribes comprising the tribe Coprini (Scarabaeinae). The 150 or so species of Phanaeina are presently included in ten genera, by far the largest of which is *Phanaeus*[2].

Phanaeines are restricted to the New World and principally to South America, though *Phanaeus* is well represented in Mexico and the United States. *Phanaeus jasius* is extremely widely distributed east of the Andes, occurring throughout the Amazon Basin southward to Bolivia and Paraguay. *P. saphirinus* is found from southern Brazil and northern Argentina westward into the Bolivian lowlands. As is generally the case for species of *Coprophanaeus* and *Metallophanaeus*, both species are necrophagous forest dwellers. They are very abundant locally during rainy seasons and are usually attracted to decaying flesh or, occasionally, to human or carnivore feces.

Laboratory work with these two species was conducted at the Departamento de Zoologia ("Museu Paulista"), Sao Paulo, Brazil. The following notes, based on rearing records, agree well with what is known in general about the biology of other phanaeines, as reviewed by Halffter and Matthews (1966). The primary purpose of this work was to obtain immatures; the unfortunate paucity of cooperating beetles precluded tampering with the rearing boxes to gain data on the nidification procedure and on other facets of dung beetle behavior.

The pear-shaped brood ball of *Phanaeus jasius* measured about 8 cm. high and 6 cm. through its greatest diameter. It consisted of a hard, spherical core about 3 cm. in diameter of very tightly packed carrion completely enclosed in an earthen cover about 1.5 to 2 cm. thick. That the food core was hard is indicated by the degree of mandibular wear in the larva (figs. 9 and 10). Even though the surrounding soil was very moist, all brood balls observed were exceptionally dry within, particularly the food core. An egg chamber was located dorsal to the food core and separated from it by a thin earthen partition. The enormous, cylindrical eggs of *jasius* were approximately 5 mm. x 10 mm. (For comparison, the length of an average adult female is roughly 30 mm.) The single larva allowed to pupate had completely consumed the food core and plastered and smoothed the wall of the resulting cavity with, presumably, the "anal paste" characteristically exuded by disturbed larvae. The pupa reposed on its back in its spherical cavity. No striking modifications of the dorsal end of the brood ball, such as those fashioned by the larva of a closely related species, *P. (C.) milon* (Blanch.) (Barrattini and Sáenz, 1953), were observed made by the larva of *P. jasius*. The brood balls of *P. saphirinus* were similar to those of *jasius* but smaller (about 6.5 x 5 cm.); other details were not observed.

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[1] Contribution No. 1358 from the Department of Entomology, University of Kansas, Lawrence, Kansas 66044. This paper reports partial results of research conducted in Brazil during tenure of a Fulbright Scholarship (1965-66).

[2] The subgeneric classification of *Phanaeus* as used here and in current use is that established by G. d'Olsoufieff (1924). Tentative results of my current research on the supraspecific systematics of the Phanaeina support the division of *Phanaeus (sensu* d'Olsoufieff) into two distinct genera, namely *Phanaeus* (to include the subgenera *Phanaeus, s. str.,* and *Sulcophanaeus*) and *Coprophanaeus* (including *Coprophanaeus, Megaphanaeus* and *Metallophanaeus).*

A female of *P. jasius* was confined with two males on 29 December, 1965, and two third instar larvae and one pupa were recovered on 22 March, 1966. Both *jasius* larvae carried mite deutonymphs (Acaridei: Anoetidae) on the prothoracic shields and procoxae. A female of *P. saphirinus* was confined alone on 8 January, 1966, and two third instar larvae were collected on 22 March, 1966. These meager data imply an egg-to-pupa developmental time of about 90 days. Even though male-female cooperation in nidification is known to occur in *Phanaeus* (Halffter and Matthews, 1966: 160), the solitary confinement of a presumably already fertilized female *saphirinus* which produced young indicates that the male is not an absolutely necessary partner for nidification in this species.

METHODS

The immatures described here were reared using the procedure of Lindquist (1935). Adults of *Phanaeus jasius* were collected in "meat traps," cans buried to their rims and baited with rotting meat. Field collected adults were confined in large (50 x 50 x 50 cm) screen covered wooden boxes containing tightly packed moist soil. Both *jasius* and *saphirinus* were provided and readily accepted scraps of raw meat; cow dung was refused by both species, even if it was the only potential food available. After about a month the boxes were opened and searched for brood balls, which in turn were checked for eggs or developing larvae. This procedure yielded six complete brood balls from two female *jasius* (confined with two males), four of which contained larvae, one an inviable egg and the other only the food core. Likewise, a single female *saphirinus* yielded two brood balls, both containing larvae.

Similar rearing procedures were unsuccessful for the following phanaeines collected in Manaus, Amazonas (March, 1966), probably because of the adverse climate of Sao Paulo and overcrowding: *Phanaeus (Megaphanaeus) lancifer* (L.), *P. (Coprophanaeus) dardanus* MacLeay, and *Diabroctis* (= *Taurocopris) mimas* (L.).

Larvae and pupa were killed in boiling water, injected with Dietrich's solution and preserved in 70% ethanol.

The descriptions are based on the following material: *Phanaeus (Coprophanaeus) jasius* Oliver—two third instar larvae, one cast integument of third instar larva and one pupa, siblings from female collected in meat trap on 16 November, 1965, at Fazenda Barriero Rico (a ranch), 5 km. N. Anhembí, Sao Paulo, Brasil (W. D. Edmonds, col.). *P. (Metallophanaeus) saphirinus* Sturm—two third instar larvae, siblings from female collected on human feces, January

1966, at Nova Friburgo, Rio de Janeiro, Brasil (J. H. Guimaraes, col.).

The terminology used in the descriptions of larvae is largely that used by Ritcher (1966 and elsewhere) and other American workers. Following is a list of abbreviations used in the figures and parenthetically in the descriptions:

aa —seta of the anterior angle of the frons
abp —abdominal projections of the pupa
afs —anterior frontal setae
an —anal slit
ant —antenna
ap —anterior process of the prothoracic shield
br —brustia
C —clypeus
car —cardo
cpa —chaetoparia
des —dorsoepicranial setae
dms —dorsomolar setae
E —epicranium
ecs —exterior clypeal setae
ep —elytral pad
eps —epicranial suture
F —frons
fs —frontal suture
ga —galea
gl —glossa
L —labrum
lac —lacinia
lb —labium
les —lateral epicranial setae
lms —lateral mandibular setae
lp —labial palpus
m —molar lobe of mandible
ma —mandibular acetabulum
mc —mandibular condyle
md —mandible
mep —mesothoracic projection of pupa
mp —maxillary palpus
mtp —metathoracic projection of pupa
mx —maxilla
o —oncylus (=hypopharyngeal sclerite)
pe —pedium
pfs —posterior frontal setae
ph —phobae
pp —pronotal prominence of pupa
ps —prothoracic shield
Pthx—prothorax
ptt —pternotorma
S_{1-3} —scissorial teeth of mandible
se —sensory spot
st —stipes
str —stridulatory teeth of stipes
t —torma
tib —tibia of foreleg of pupa
ts —tarsal sheath
tsp —tibial spur
ung —uncus of galea
unl —uncus of lacinia
vms —ventromolar seta tuft
wp —hind wing pad

DESCRIPTIONS

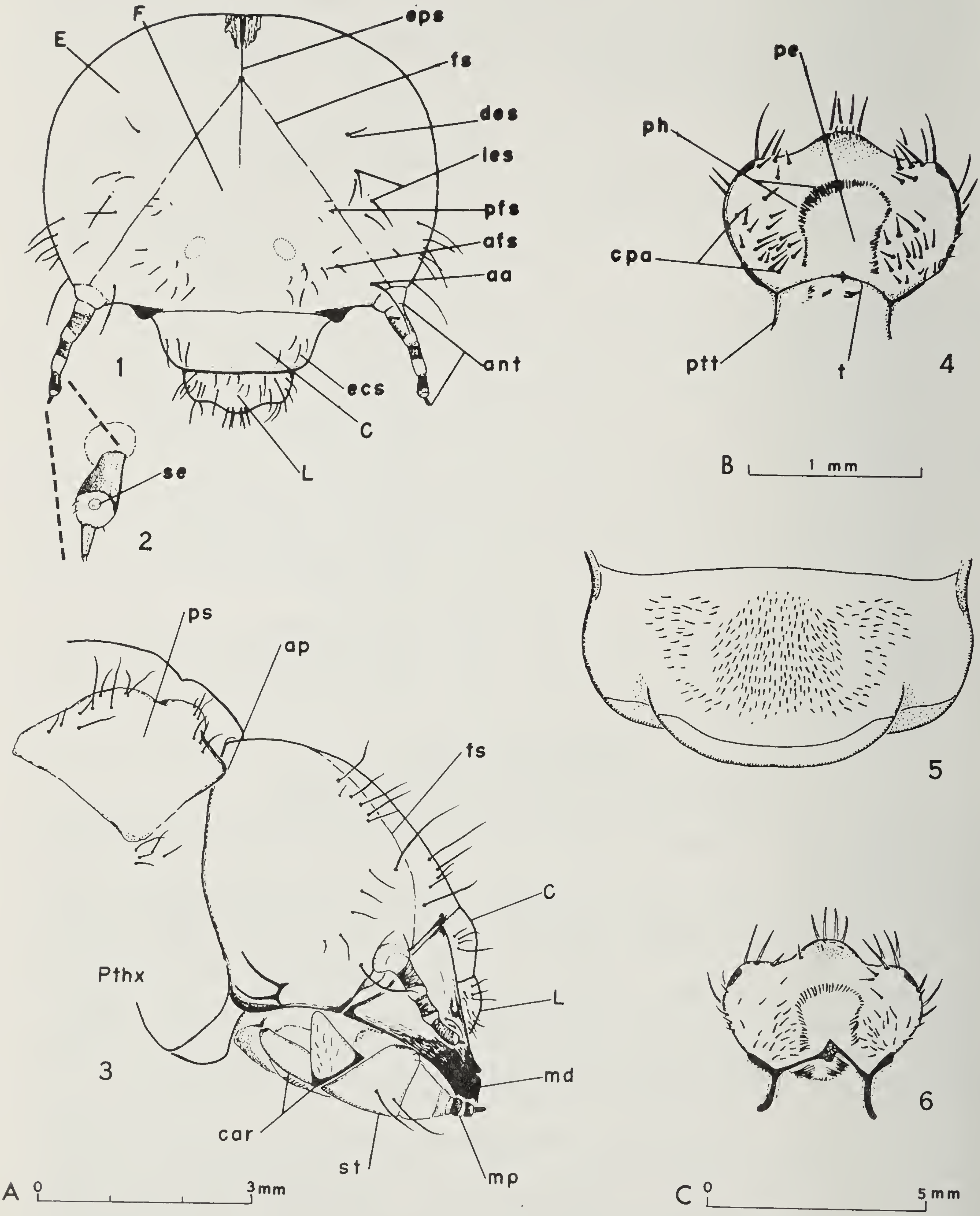
Phanaeus (Coprophanaeus) jasius Oliver

Third instar larva (Figs. 1-5, 7-11, 15, 16)

GENERAL: Body C-shaped, "humped" dorsally, flattened caudally; total dorsal length 5.5-6.5 cm.

HEAD CAPSULE. (figs. 1, 3): Flattened anteriorly, rounded laterally, maximum width 5.5-5.8 mm.; epicranial suture (eps) widened dorsally, extended anteriorly beyond juncture of frontal sutures; frontal sutures (fs) straight. Epicranium (E) and frons (F) straw-colored. Cranial setae on each side as follows: dorsoepicranial setae (des) single or paired; 4 or 5 loosely grouped lateral epicranial setae (les); 3 small posterior frontal setae (pfs); irregular groups of 8 to 10 anterior frontal setae (afs); one seta (aa) in anterior angle of frons. *Clypeus* (C) straw-colored except narrow lighter distal margin; each side with three exterior clypeal setae (ecs). *Labrum* symmetrical, weakly trilobed, median lobe with 8 marginal setae, exposed surface with randomly scattered setae. Epipharyngeal surface of labrum (fig. 4): chaetopariae (cpa) each with 15 to 20 stout, prostrate setae; pedium (pe) bare, bulging on left side; phobae (ph) forming asymmetrical loop of prostrate setae, appearing erect on left because of bulge of pedium; mesophoba reduced to irregular clusters of fine hair-like setae behind united tormae; tormae (t) very narrow, united mesally, each with narrow pternotorma (ptt); epitormae reduced. No haptomerum or macrosensillae observed.

HEAD APPENDAGES: *Antennae* (ant) four-segmented (figs. 1, 3), basal two



Figures 1-6. *Phanaeus (C.) jasius* Oliv., larva. 1—Head, anterior view (mandibles removed). 2—Third and fourth segments of right antenna, inner surface view. 3—Head and portion of prothorax, lateral view. 4—Epipharyngeal surface of labrum. 5—Venter of tenth abdominal segment. Figure 6. *Phanaeus (M.) saphirinus* Sturm, larva. Epipharyngeal surface of labrum. Scale A—figs. 1, 3; B—4, 6; C—5.

segments nearly fused, distal segment much reduced; third segment with round sensory spot (se) on inner side near apex (fig. 2). *Mandibles* (md) (figs. 8-10): left mandible with three separated scissorial teeth (S_{1-3}); right mandible with first and second teeth fused, separated from third by small notch. Dorsomolar setae (dms) of both mandibles arranged in oblique row; left mola (m) concave; right mola flattened, with prominent tooth directed mesally from anterior margin and with fringe of very short stiff setae along outer side of apex; brustia (br) of left mola of many setae, that of right mola reduced to single small tuft; tuft of ventromolar setae (vms) present on both mandibles; scrobis of both mandibles represented by one long lateral mandibular seta (lms). *Maxillae* (figs. 3, 7): cardo (car) distinctly tripartite; stipes (st) with 14 or 15 stridulatory teeth (str) in irregular row; uncus of lacinia (unl) strongly developed, without basal tooth; uncus of galea (ung) a small apical sclerotized pad; palpus (mp) four-segmented, basal segment very weakly sclerotized, distal segment with apical sensory spot. Setation of maxilla as in figure 7. *Labium* (fig. 11): oncylus (o) (= hypopharyngeal sclerite) of two irregular plates; glossa (gl) bounded posteriorly by transverse row of many very short setae; palpus (lp) two-segmented, distal segment with apical sensory spot.

THORAX: Prothoracic shields (ps) present, with prominent anterior angle (ap) (fig. 3); thoracic spiracular plate twice size of abdominal spiracular plates. Legs two-segmented, apex of each (fig. 15) with two long setae surrounded by 12 to 14 short, spine-like setae.

ABDOMEN: third tergum without projecting "wart"; each tergum with transverse polystichous row of sparsely set setae, otherwise bare. Setation of venter of tenth segment as in figure 5. Anal slit (an) transverse, surrounded by prominent lobes (fig. 16).

Pupa (Figs. 12-14)

Matthews (1963) noted the lack of any taxonomic basis for the description of scarab pupae. Since this is still the case, description of the pupa will be limited to the illustrations and mention of the following features:

a. Pupal support projections are present as follows (fig. 14): two rather large, closely set, flattened lobes (pp) near middle of anterior margin of pronotum; a small, papillar protuberance (mep) near posterior margin of mesonotum; a finger-like, recumbent lobe (mtp) originating near posterior margin of metanotum; short, lobe-like projections (abp) from each side of abdominal terga 2-6, varying somewhat in size and shape. (Indistinct projections also occur on tergum 7.) In addition, large swellings on the base of the elytral pads are apparently support points.

b. Abdominal terga 1-6 each bearing a pair of spiracles; atria of first three pairs project beyond the body wall. Spiracles on tergum 7 are absent or concealed in folds of the integument. (Adults have seven distinct pairs of spiracles.)

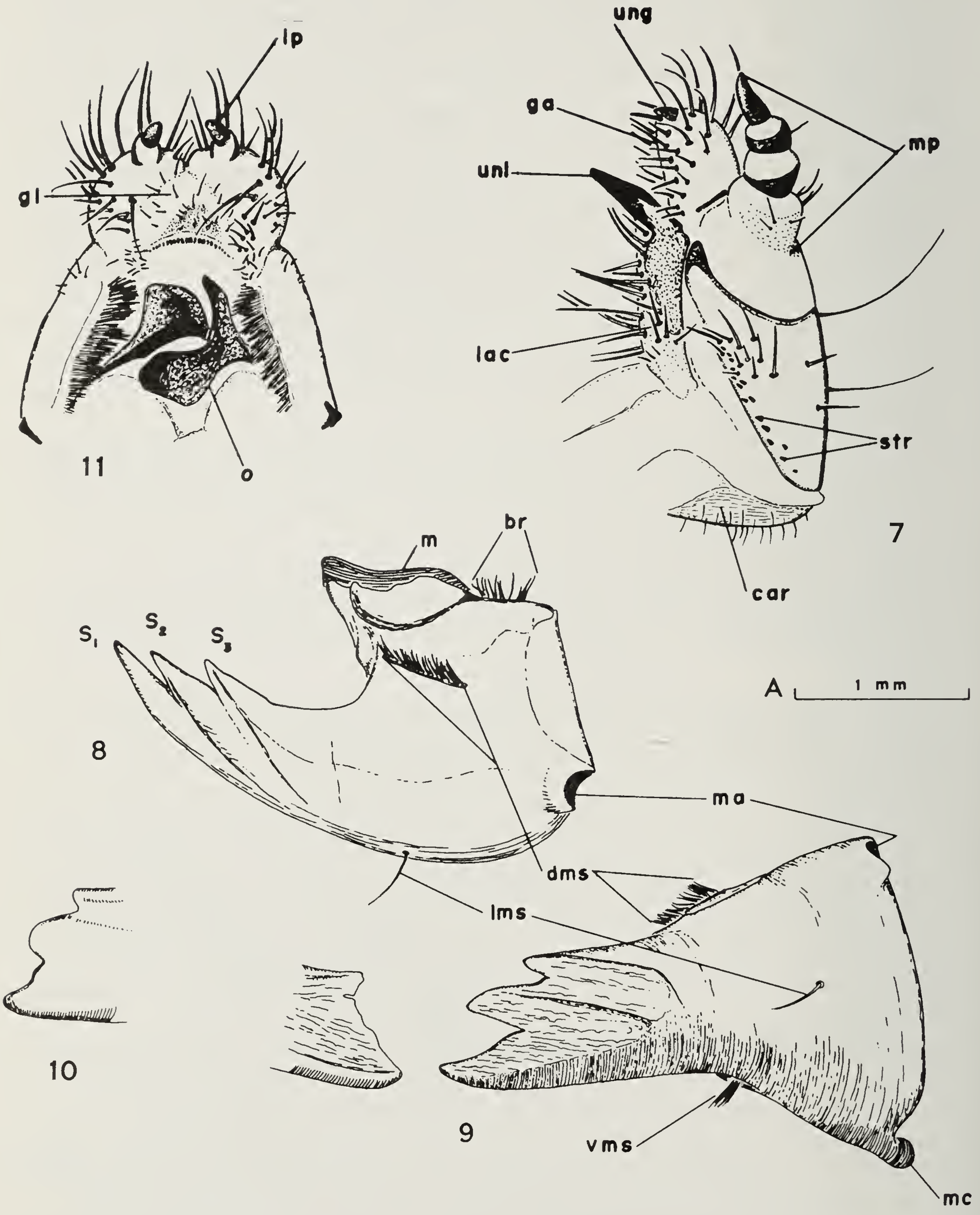
c. The apex of the foretibiae (figs. 12, 13), at the base of the developing tibial spur (tsp), bears a hollow, indistinctly segmented integumental evagination (ts) apparently representing a tarsal sheath which contains no developing tarsus.

The structure of the cephalic process, apparent lack of a developing genital capsule and presence of tarsal sheaths indicate that this pupa contains a developing female. Total body length—30 mm.

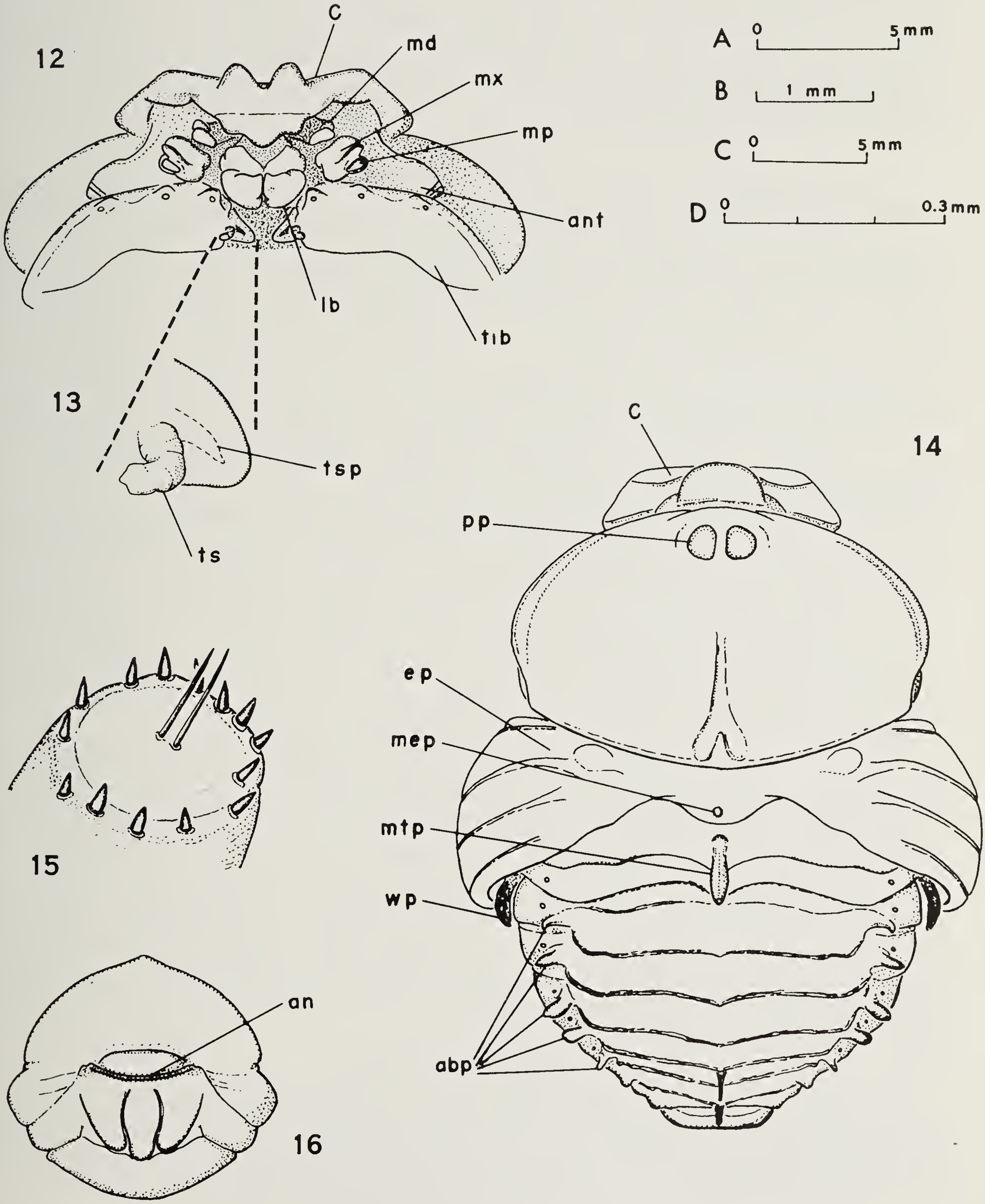
Phanaeus (Metallophanaeus) saphirinus Sturm

Third instar larva (Fig. 6)

Because of their great similarity, description of the larva of *Phanaeus saphir-*



FIGURES 7-11. *Phanaeus (C.) jasius* Oliv., larva. 7—Maxilla, anterior view. 8—Left mandible, anterior view. 9—Left mandible and scissorial area of right mandible, lateral view. 10—Worn scissorial area of left mandible of cast integument. 11—Labium, anterior view. Scale A—figs. 7-11.



FIGURES 12-16. Larva and pupa of *Phanaeus (C.) jasius* Oliv. 12—Anterior end of pupa, ventral view. 13—Tip of right foreleg of pupa, ventral view. 14—Dorsal aspect of pupa. 15—Tip of metathoracic leg of larva. 16—Anal area of larva, caudal view. Scale A—figs. 12, 16; B—13; C—14; D—15.

inus will be limited to mention of those features observed to differ from their counterparts in *P. jasius.*

GENERAL: Total dorsal length 4.5-5.2 cm.

HEAD CAPSULE: Maximum width 4.6-4.8 mm; dorsal and lateral epicranial setae together forming a loose group of 4 or 5 setae; one short posterior frontal seta; two irregular groups of 5 or 6 anterior frontal setae; each anterior angle of frons with two unequal setae; 4 or 5 exterior clypeal setae per side. Epipharyngeal surface of labrum (fig. 6): chaetopariae each with 20 to 23 setae; mesophoba reduced but less so than in *jasius;* tormae united asymmetrically. HEAD APPENDAGES: Maxillae: stipes with 9 or 10 stridulatory teeth; uncus of lacinia with two very small basal teeth.

COMMENTS

To my knowledge only one other phanaeine larva has been described well enough for present comparative purposes, that of *Phanaeus (P.) vindex* MacLeay (Ritcher 1945, 1966). The notes given by Judulien (1899) on the larvae of some Argentine dung beetles, including several phanaeines, need confirmation. Ohaus' description (1913) of the larva (and pupa) of *Phanaeus floriger* Kirby (= *P. (P.) splendidulus* (Fab.)) is only detailed enough to indicate the general resemblance of *floriger* to the larvae described here. Besides these phanaeines, larvae of only a few other Coprini have been adequately described: *Ateuchus histeroides* Web., *Dichotomius carolinus* (L.) (as *Pinotus), Copris minutus* (Drury) and *C. fricator* (Fab.) by Ritcher (1945, 1966); *Copris lunaris* (L.) and *Synapsis tmolus* (Fischer) by Medvedev (1952).

The larvae of *Phanaeus jasius* and *P. saphirinus* differ in the following features from the larva of *P. vindex,* as described and figured by Ritcher: 1) straight frontal sutures, 2) reduced epitormae, 3) reduced mesophoba, 4) number of setae of chaetoparia and 5) legs each with two long, terminal setae. *P. saphirinus* differs further by having two setae on each anterior angle of the frons. Except for reduction of the mesophoba, these two species agree with Ritcher's (1966) characterization of the larvae of Scarabaeinae; but character 5 above will misplace them in his key (p. 14) to known scarabaeine genera.

Very few accounts have appeared of the pupae of Coprini. Halffter and Matthews (1966: 186) offer some comparative data on the support projections of the pupae of species of *Copris,* and Ohaus (1913) mentions those borne by the pupa of *Phanaeus floriger.* Except for possible differences in the pronotum, the pupal support projections of *P. jasius* correspond exactly with those of *P. floriger.* The presence on the pupa of *jasius* of front tarsal sheaths is noteworthy. No known adult male phanaeines have front tarsi; they are characteristically absent in the females of several groups, including the subgenus *Coprophanaeus.* The tarsal sheaths thus represent a clear case of pupal retention of a character lost in the adult.

Acknowledgments

I am indebted to Dr. P. E. Vanzolini, Director, and to Padre F. S. Pereira CMF of the Departamento de Zoologia, Secretaria da Agricultura, Sao Paulo, Brasil, for use of facilities in Sao Paulo. My thanks also to Dr. G. W. Byers and Dr. E. G. Matthews for their help in preparation of the manuscript.

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THE NORTH AMERICAN FIREFLIES OF THE GENUS PHOTURIS DEJEAN
A MODIFICATION OF BARBER'S KEY (COLEOPTERA; LAMPYRIDAE)

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Barber (1951, pp. 20-24) gave a key to the North American species of the firefly genus *Photuris.* This key is based largely on the differences in coloration of the coxae, legs, ventral abdominal segments, and other structures; in practice, the key has been found confusing owing to the considerable and overlapping variation in coloration of the various species, and Barber evidently recognized this difficulty. The few new species that have been described offer little as specific coloration.

Of the nineteen species and varieties covered by Barber's key all but five are in the *versicolor* group, distinguished by a pronotal marking consisting of a median longitudinal black vitta of varying outline with a red or orange spot on each side of it; the differences in extent and form of the black vitta are of diagnostic value when considered in connection with other data. Probably there are undescribed species belonging in this group. The *brunnipennis* group and the *frontalis* group, neither having this type of pronotal marking, should also be represented by other species. *Photuris divisa* appears to be unique among the North American species, but a similar marking of the pronotum has been seen in some South American species. However, *divisa* may represent a branch of the *versicolor* group which has lost the pronotal red spots. *P. jamaicensis* E. Oliv., of Jamaica, which otherwise resembles the *versicolor* group, lacks these spots but was mistaken for *versicolor* by Gosse (1851) and probably for *pennsylvanica* by Gorham (1880, p. 110).

Barber actually based his specific identifications of the members of the *versicolor* group on the pattern of the flash of the males; unfortunately this essential information is usually not available to the museum worker. Barber's familiarity with the species producing different flashes enabled him to identify some of them from dried specimens but he did not record all of the minute differences which enabled him to do so. When series representing the various species [identified on basis of behavior] are arranged in a collection the differences in appearance between the series is rather pronounced even though individually it may be difficult tc find constant distinctive characters. It was noted by Barber that insects having the same flash pattern form pure colonies, an observation I have also made.

I have made many attempts to develop a dichotomous key to the members of the *versicolor* group which could be used for the positive identification of museum specimens but constant morphological and color differences between most of the species just do not exist. In a few species the elytral coloration and markings are practically constant, making this feature of diagnostic value. The size range is important, and to some extent the geographic distribution also. There is essentially no variation [interspecific, see Barber, 1951, p. 19] in the aedeagus except in length, which generally parallels the over-all body size.

Another point which requires mention is that of the apparent color of the emitted light; as noted in McDermott and Buck (1959) the apparent color is considerably affected by the background. Thus the orange tint in the flash of *P. hebes* is usually not noticeable. The color of the flashes of *P. pyralomima, P. caerulucens,* and *P. aureolucens* are probably sufficiently different from the usual greenish flash of *versicolor* to be significant.

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[1] Deceased.

Some of Barber's characters were undoubtedly recorded from the examination of fresh specimens, but at the time of my examination of his specimens they were at least twenty years old and were probably discolored—white tends to become yellowish, yellow may become brown, and lighter brown may darken.

The species are therefore here divided into groups based on size differences and on variation in the pronotal vitta. Much of Barber's original data have been included, hoping that it may be of assistance. Using the key will require comparison of data other than coloration but it is hoped that it may be of value for at least the tentative identification of the species when the flash pattern of the male is unknown. Ratios are generally unreliable; however some species have noticeably long or short antennae, or posterior legs. A summary of the male flash patterns is given at the end of the key.

Females are similar to the males, frequently larger; the luminous tissue on the 6th and 7th ventral segments is more limited, the eyes smaller and antennae shorter.

Adequate records of the times of first appearance and of maximum prevalence, and also the periods of nocturnal activity, might separate some species for a given locality. Thus in the Wilmington, Delaware, area, *P. versicolor* usually appears about May 28, followed shortly by *P. hebes,* while *P. lucicrescens* is usually about a week later in appearing. All three have been observed in flight from sundown to well into early morning, though becoming much less numerous after midnight.

KEY

1. Pronotum with or without a central infuscate area but always *without* a pair of oval red discal spots 2
Pronotum with a median longitudinal vitta with a conspicuous red or orange spot on each side (*versicolor* group) 7
2. Pronotum entirely pale yellow (*brunnipennis* group) 3
Pronotum otherwise 4
3. 8.4-11.5 mm long, *ca.* 3.5 mm broad, subparallel. Elytra entirely black. Labial margin triangulate. Metasternum concolorous with yellow head and thoracic sternites above and below. Fifth ventral sternite with pale posterior margin, the lutescent area broad at middle, narrower toward but not reaching sides. Apical infuscation of femora gradual and barely noticeable, but knees including base of tibiae, pale. Flash pattern of male not recorded. Habitat alticolous. Type locality Alpine, Texas. (*flavicollis* Fall 1927, nec E. Olivier 1886.) .... BRUNNIPENNIS var. FALLI Barber (1951)
9.5-11.0 mm long, *ca.* 3.1 mm broad, nearly parallel. Elytra black with narrow sutural and wider lateral borders yellow, not continuous around apices. Head, prothorax, and mesothorax yellow above and below; metasternum piceous. Labrum short, light brown, edge narrowly darker, no obvious denticles. Antennae black, *ca.* 5.1 mm long, 0.54 of body length. First four abdominal ventral sternites black, the fourth sometimes faintly paler at middle. Luminous segments rather deeply emargi-

nate. Coxae and basal five-sixths of femora yellow; knees, tibiae, and tarsi black; posterior legs 7.05 mm long, 0.74 of body length. Male flash short, single. Habitat marshy ground. Type locality Paradise Key, Florida... BRUNNIPENNIS var. FLORIDANA Barber (1951)

4. Pronotum with median line dividing the central infuscate area (*divisa* group) 5
   Pronotum medially infuscate without a dividing line (*frontalis* group).. 6
5. 9.5-10.0 mm long, *ca.* 3.1 mm broad; subparallel. Pronotal trapezoidal discal infuscation divided by a pale median line. Elytra varying from light brown with poorly defined pale marks to dark brown with sharply defined yellow markings. Frons wide, infuscate, interocular margins only slightly divergent, differing in this from most species; labrum short, light brown, with rather prominent median denticle. Antennae light brown, 4.5-5.35 mm long, 0.47-0.5 of body length; third article longer than second. First four ventral abdominal segments brown; the fourth may be darker with pale posterior edge; last segment with a rather sharp median point. Coxae and femora brownish yellow, knees darker; tibiae and tarsi brown; lobes of fourth tarsal article relatively short. Posterior legs 6.3-6.6 mm, *ca.* 0.66 of body length. Flash of male short, single, repeated continuously at short intervals. Habitat fields. Type locality Missouri Territory (LeConte); probably Nebraska.................. DIVISA LeConte (1852)
6. Larger, 12.0-13.5 mm long, 4.2-5.2 mm broad; slightly elliptical. Pronotum with infuscate area abruptly limited, usually twice as long as wide and constricted at basal third. Elytra brown to black; wide lateral and narrow sutural margins pale, sometimes continuous around apices. Frons ivory-white to flavous; labrum short, dark brown, tridentate. Antennae dark brown to black, to 7.65 mm. long, 0.57 of body length. First four ventral abdominal segments brown, the last segment with a median point; luminous segments not as much longer than the preceding segment as usual in most species and not deeply emarginate. Coxae light brown, femora light brown proximally, darker distally; tibiae and tarsi dark brown. Posterior legs of larger specimen 10.15 mm long, 0.76 of body length. Flash of male short, bright, single, yellowish coruscations, regularly at less than one second intervals. Habitat around lower branches of trees near river (Maryland). Type locality Georgia........... FRONTALIS LeConte (1852)

   Smaller, 9.0-11.0 mm long, 4.0 mm broad; outline parallel. Pronotal infuscate area large, oval, not constricted, and shading imperceptibly into yellowish border; may be reduced to two indefinite brown streaks. Elytra brown, without vittae; wide lateral and narrow sutural margins yellow, continuous around apices. Frons yellow, interocular margins very divergent; labrum brown with median denticle. Antennae *ca.* 5.0 mm long. First four ventral abdominal segments brown, the fourth with paler posterior edge; last segment with a median point. Coxae light brown; femora proximally light brown shading to dark brown at knees; tibiae and tarsi dark brown; fifth tarsal article appears shorter than in most species; posterior legs 0.75 of body length. Flash

(Florida) 20 or more short coruscations in rapid succession. Habitat low areas, probably sandy and marshy. Type locality Georgia..............
CONGENER LeConte (1852)

7. Pronotal median vitta as in VERSICOLOR........................ 8
Pronotal median vitta modified—narrowed, interrupted, constricted or otherwise........................ 11

8. Average length (pronotum plus elytra) more than 12 mm........................ 9
Average length 12.0 mm or less........................ 10

9. 13 to 16 mm long (females to 18 mm), 4.5-5.5 mm broad; subparallel. Elytral color very variable, from yellowish tan to almost black; vittae usually well marked but short; lateral and sutural margins yellow, continuous around apices. Frons yellow; labrum brown, prominently tridentate, and extending about half way to the closed mandibles. Antennae about 0.6 of body length, but variable; bases of articles strongly flavous; articles 4 to 10 longer than first article. First three ventral abdominal segments dark brown, fourth brown with posterior third white; last segment white with median point. Coxae dark brown, posterior pair may be paler; tibiae and tarsi brown, bases of tarsal articles flavous; posterior legs long, *ca.* 0.76 of body length. Flash of male composed of 3 to 6 components in rapid succession, bright, greenish; repeated at five to ten second intervals. Habitat preferentially along streams but found over fields and around trees at some distance from water; females on tall grass and grains and low shrubbery. Type locality "North America"; probably generally present along the Atlantic Coast and westward at least to the Mississippi River..............................
VERSICOLOR Fabricius*

13-16 mm long, 4.5-5.0 mm broad; darker and narrower than *versicolor.* Elytral vittae 0.5 of elytral length, but may be obsolescent; lateral and sutural margins ivory, continuous around apices. Frons nearly white. Antennae 0.6 of body length. Venter as in *versicolor.* Posterior legs 0.7 of body length. Male flash of four definitely spaced components, given rather slowly in horizontal flight over sand dunes and fields, and repeated at rather long intervals. Type locality Cape Henry, Virginia. Also seen at Newark, Delaware....................VERSICOLOR var. QUADRIFULGENS
Barber (1951)

13 mm long, 4.9 mm broad; subparallel or slightly elliptical. Pronotal posterior angles produced. Elytra pale to dark brown; vittae varying from obscure to sharply defined, almost reaching apices. Outline distinctly widened by wide yellow lateral margins, continuous with sutural bead. Frons ivory. Antennae black, sockets white; 0.6 of body length. Venter as in *versicolor;* last ventral segment with a rather sharp median point. Coxae brown; posterior legs *ca.* 0.76 of body length. Male flash 0.5 second long, yellow, given on a rising flight resembling that of *Photinus pyralis* but flash beginning on the descent. Habitat lawns and hayfields. Type locality Selkirk, New York.........................
PYRALIMIMA Barber (1951)

12-13 mm long, 4.0 mm broad; subparallel. Elytra dark brown with wide white lateral and narrow sutural margins continuous around apices; vittae white, *ca.* 5.0 mm long. Frons ivory. Antennae rela-

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*See discussion after the Key

tively short, *ca.* 0.5+ of body length; dark brown, articulations white. Venter as in *versicolor;* last segment with a wide-angled median point. Coxae brown. Male flash short, single, yellow, similar to that of *Photinus marginellus.* Habitat near tamarack swamp. Type locality Bluff Siding, Wisconsin..AUREOLUCENS Barber (1951)

12-13 mm long, 4.0 mm broad; slightly elliptical. Elytra light brown; wide yellow lateral margins and narrower sutural margins continuous around apices.; vittae basally wide, narrowing, and almost reaching apices. Frons ivory. Antennae black, articulations white; *ca.* 0.66 of body length. First three ventral abdominal segments dark brown, fourth white in posterior third; last segment with a wide-angled rounded point. Coxae dark brown; posterior legs 0.76 of body length. Male flash a steady bluish-green coruscation about one second long. Habitat damp ground near tamarack swamp. Type locality Bluff Siding, Wisconsin..CAERULUCENS Barber (1951)

12.5-13.5 mm long, 4.9-5.2 mm broad; nearly parallel. Pronotal vitta like *versicolor* but lateral extensions at base of pronotum short and orange spots relatively smaller. Elytra variable in color, from light greyish brown to very dark brown but tending to be paler than in *versicolor;* vittae usually long and strongly marked; lateral and sutural margins lutescent and continuous around apices. Frons white; labrum pale at base, black at apex, with small median protuberance. Antennae dark brown, articulations white; 0.62-0.65 of body length. First four ventral abdominal segments mostly light brown with some irregular paler areas; last ventral segment pale, with a triangular median point. Coxae pale; posterior legs *ca.* 0.76 of body length. Characteristic flash of male 0.75-2.5 seconds long, greenish white, usually given in a poising, somewhat spiral flight, increasing in brilliance and ending suddenly, illuminating foliage for several feet around; may appear vibratory or flickering; sometimes gives single, short, brilliant flashes. Habitat usually around trees along banks of streams. Type locality Priest's Bridge, Patuxent River, Maryland. Also seen at Newark, Delaware, and in Louisville, Kentucky...................................LUCICRESCENS Barber (1951)

10. 12 mm long, 4.0 mm broad; nearly parallel. Pronotal vitta not extended laterad at base and orange spots nearly reach base. Elytra light to dark brown with narrow pale lateral and sutural margins, and long, narrow pale vittae. Frons white; labrum brown, covering the closed mandibles. Antennae brown, rather short, 0.5 of body length, articles 4 to 8 inclusive about 3.0 mm long. First three ventral abdominal segments brown, the fourth about one-half white; last segment with a median point. Coxae light brown; posterior legs *ca.* 0.69 of body length. Flash of male of two components separated by an interval about twice as long as one component; flashing irregular. Habitat over marshy ground. Type locality Cape Breton Island, Nova Scotia. FAIRCHILDI Barber (1951)

10.0-12.5 mm long, 4.2-4.6 mm broad; slightly elliptical. Pronotal vitta similar to that of *versicolor* but widening toward base, giving the effect of a long triangle (cf. *P. potomaca*); lateral extension along the base short or absent; orange areas large. Elytra medium to dark brown;

oblique vittae short; wide lateral and narrow sutural margins yellow, continuous around apices. Frons ivory; labrum short, dark brown, with three dull denticles. Antennae black, articulations white; 0.6-0.63 of body length. First four ventral abdominal segments brown, the fourth with narrow white posterior margin. Coxae brown; posterior legs *ca.* 0.8 of body length. Flash of male 0.5-1.0 second long, tremulous or vibrating, brilliant, greenish. Habitat low swampy ground. Type locality Black Pond, Virginia (near Great Falls, Potomac River). Also taken at Concord, Mass.............................**TREMULANS** Barber (1951)

11-12 mm long, 3.5 mm broad, subparallel. Pronotal black vitta narrow with little extension along base. Elytra dark brown with pale wide lateral margins and narrow sutural margins, continuous around the rather unusually acute apices; oblique vittae absent or obsolescent; epipleura white. Frons white; labrum dull white, edge brown; a median point and two dull lateral denticles. Antennae dark brown, articulations white; *ca.* 0.62 of body length. First four ventral abdominal segments mainly brown, irregularly white in posterior third to half. Legs white; posterior pair long, *ca.* 0.85 of body length. Flash of male not recorded, probably single. Habitat stream sides. Type locality Sherwood Forest, Severn River, near Annapolis, Maryland.........**CINCTIPENNIS** Barber (1951) (This species appears to be rather widely distributed in the Atlantic Coast states, but perhaps in rather scattered localities. Its identity with *lineaticollis* LeConte 1852 or Motschulsky 1854 seems very doubtful.)

8.0-10.0 mm long, 3.0-3.5 mm broad; slightly elliptical. Pronotal vitta as in *versicolor,* sometimes broadened. Elytra brown; wide yellow lateral and sutural margins continuous around apices; oblique vittae variable, to two-thirds elytral length. Frons ivory; labrum short, dark brown, dull median denticle. Antennae short, *ca.* 0.45 of body length; brown. First four ventral abdominal segments light brown, posterior third of 4 white. Posterior legs *ca.* 0.74 of body length. Male flash a bright, sharp, coruscation followed immediately by a 1 to 2 second long flash, decreasing in brilliance and given while poising over tall grass. Habitat swampy areas or near them. Type locality probably near Wilmington, Delaware. Also collected at Oneida, New York, at Riverton, New Jersey, and Washington, D. C. (?*Telephoroides vittigera* Motschulsky 1854, p. 60)......................................**PENNSYLVANICA** DeGeer

9.15-11.45 mm long, 3.4-4.0 mm broad; slightly widest at one-half elytral length. Pronotal black vitta generally similar to *versicolor.* Elytra practically black; margins, suture, and pronounced sharply defined oblique vittae white. Frons yellow; labrum dark brown, tridentate. Antennae black, rather short, *ca.* 0.5 of body length. First four ventral abdominal segments black; last segment rather long and medially short-mucronate. Coxae almost white; posterior legs long, *ca.* 0.87 of body length. Male flash of single coruscations 0.2 second long at 4 to 5 second intervals (at 75° F.); longer flashes (at lower temperatures) and shorter intervals also observed; some evidence of flickering. Habitat various areas in Florida, some on the Gulf coast. Type locality Highlands Co., Florida.............................**LLOYDI** McDermott (1967)

11. 9.35-12.0 mm long, 3.2-4.5 mm broad; subparallel. Pronotal vitta a

long, narrow triangle from the base (cf. *P. tremulans*). Elytra light brown with wide white lateral and narrow sutural margins; oblique vittae white, *ca.* 0.5+ of body length. Frons ivory; labrum dark brown with three dull denticles. Antennae brown, articulations white; 7th article somewhat the longest; length variable, 0.55-0.65 of body length. First three ventral abdominal segments brown, fourth usually mostly white medially; last segment white with median point. Coxae brown; posterior legs 0.76 of body length. Male flash single, short, greenish, at regular intervals of about 1 second. Habitat woods along river banks. Type locality Offutt Island, in Potomac River 2.5 miles below Great Falls. (Possibly present in Florida.)....................POTOMACA Barber (1951)

10.5-12.0 mm long, 2.8-3.0 mm broad, practically parallel. Pronotal vitta resembling *versicolor* but tending to be narrow, sometimes reduced to a line by enlargement of the orange areas. Elytra usually light brown, occasionally darker; wide white lateral and narrow sutural margins continuous around apices; oblique vittae narrow, white, usually more than 0.5 of elytral length, and may be evanescent. Frons ivory to yellow; labrum pale to brown, sinuate. Antennae noticeably long, *ca.* 0.7 of body length; dark brown, articulations white; article 10 and 11 shorter than 4 to 9. First ventral abdominal segment yellow, second light brown, third darker, fourth largely mottled white; last segment white with long median point. Coxae yellow; posterior legs long, *ca.* 0.8 of body length. Male flash single, sharp, yellowish green, sometimes with an orange tinge; not brilliant; interval between flashes 1 to 5 seconds. Habitat willow-covered fresh-water lowlands (Barber); fields and around trees. Type locality outlet of Black Pond, Virginia (below Great Falls, Potomac River.) Common in northern Delaware. Barber remarked that there is a similar species in the Florida Everglades; one specimen from Florida has the last two abdominal segments black, possibly a pathologic condition................HEBES Barber (1951)

9.0-12.0 mm long, 3.2-4.1 mm broad; slightly elliptical. Differs from *P. hebes* by broader form, shorter antennae, and usually darker elytra. Pronotal vitta hour-glass shaped. Elytra light to darker brown; wide white lateral and narrow sutural margins continuous around apices, sometimes indistinctly. Frons yellow; labrum practically black, feebly tridentate. Antennae 0.5-0.6 of body length, brown; articulations noticeably pale. First four ventral abdominal segments light to dark brown, the fourth may have a pale posterior margin; last segment white with a hairy median point. Posterior legs *ca.* 0.7 of body length. Flash of male similar to that of *P. hebes*. Habitat the drier margins of salt marshes. Type locality Sherwood Forest, 7 miles northwest of Annapolis, Maryland. Also collected at Bombay Hook Refuge, Delaware..........................
SALINA Barber (1951)

11.25-13.7 mm long; average 12.6 mm long and 4.2 mm broad; subparallel. Pronotal vitta frequently short, basal, sometimes complete, narrow. Elytra light brown, appearing darker over wings, and basally darker; pale lateral margins to apical fourth, sutural bead pale to mid-length; oblique vittae pale, frequently short or absent, sometimes reaching apical third. Frons yellow; labrum nearly black, tridentate. Antennae dark brown, *ca.* 0.6 of body length; articulations pale; sixth article longest. First four ventral abdominal segments dark brown, posterior edge of fourth pale; last segment small, medially pointed, densely hairy. Coxae yellow; posterior tarsi long, 3.3 mm. Male flash single, repeated at two or three second intervals. Habitat grassy fields with few trees, near river; some swampy ground. Type locality Roaring River State Park, Missouri........................MISSOURIENSIS McDermott (1962)

9.0-10.75 mm long, 3.5-4.0 mm broad; slightly elliptical. Pronotal black vitta usually divided into a larger subapical spot and a smaller basal spot, sometimes connected by a line; rarely of the *versicolor* pattern. Elytra brown to nearly black, wide yellowish margins give an elliptical outline; sutural bead pale and narrow; oblique vittae pale, to *ca.* 0.75 of elytral length. Frons yellow; labrum brown, obscurely tridentate. Antennae dark brown, articulations pale, at least the basal three in the female; 0.55-0.58 of body length in male, about 0.45 in female. First four ventral abdominal segments usually brown, the fourth may be yellow. Luminous areas in female a transverse bilobed organ on the 5th segment and a relatively large elliptical organ on the 6th segment. Legs rather long for a small photurid. Flash of male of two short, greenish components separated by an interval somewhat longer than one component *(cf. P. fairchildi)*, the second component frequently weaker than the first and sometimes omitted; the double flash repeated at intervals of 5 seconds or more. Habitat around bayberry bushes on sand dunes and adjoining sandy fields. Type locality Bethany Beach, Delaware. BETHANIENSIS McDermott (1953)

14.0(?)-18.0 mm long, to 4.8 mm broad; long subparallel. Pronotal vitta frequently merely a line, sometimes divided into a larger rounded anterior spot and a narrow prescutellar spot. Elytra dark brown; suture and lateral margins narrowly yellow, not continuous around apices; oblique pale vittae sometimes present to 0.5 of elytral length, frequently obsolescent or absent. Frons yellow; labrum black, prominently tridentate. Antennae black, articulations not pale; *ca.* 7.5 mm long, 0.41-0.53 of body length. First four ventral abdominal segments dark brown. Fore and mesocoxae dark yellow, posterior pair brown. Flash of male not known. (All specimens so far examined have been females.) Habitat various places in Florida and Louisiana. Type locality Florida. (? *Telephoroides lineaticollis* Motschulsky 1854) LINEATICOLLIS LeConte (1852.*)

LOCATION OF TYPES OF NORTH AMERICAN SPECIES OF *Photuris*

Barber's types are in the U. S. National Museum, as is also the type of *P. bethaniensis.*

P. missouriensis is in the California Academy of Sciences.

P. lloydi is in the collection of Cornell University.

LeConte's types are probably mostly in the Museum of Comparative Zoology at Harvard.

DeGeer's types, if still extant, may be in the Zoological Institute of the University of Lund, Sweden.

**P. lineaticollis* is given as a synonym of *P. pennsylvanica* by Olivier (1886, p. 234) and by Gorham (1880, p. 110). Gorham's list undoubtedly covers several species, and the occurrence of *lineaticollis* in Quebec is certainly doubtful.

A Guide to the Flash Patterns in the *P. versicolor* group

Type of flash:	Species:	No. in list:	Position in key:
1. Single, short	*aureolucens*	9	9
	(lucicrescens)	11	9
	cinctipennis (?)	14	10
	lloydi	16	10
	potomaca	17	11
	hebes	18	11
	salina	19	11
	missouriensis	20	11
2. Single, long			
a. not vibratory—			
yellow,	*pyralomima*	8	9
bluish,	*caerulucens*	10	9
b. vibratory—			
brilliant, crescendo,	*lucicrescens*	11	9
tremulous, not crescendo,	*tremulans*	13	10
3. Double, of two components			
c. components alike, short interval between them,	*fairchildi*	12	10
	bethaniensis	21	11
d. 1st component short, brilliant, 2nd without interval, long, diminishing,	*pennsylvanica*	15	10
4. Three to six components, usually in rapid succession.	*versicolor*	6	9

Photuris pennsylvanica AND *P. versicolor*

At the end of my notes on Barber's specimens (Barber, 1951, p. 56) I left open the question of the identity of the above species; a review of the situation is given below.

Photuris pennsylvanica was described by DeGeer (1774) from specimens sent to him by Acrelius (1759) from the vicinity of Wilmington, Delaware; DeGeer spelled the name *pensylvanica,* perhaps a *lapsus calami* or due to DeGeer not being aware of the origin of the word. Fabricius (1798) described *P. versicolor* from specimens sent him from North America by Dom. Hirschell. Hirschell also collected in the Antilles.) The two species have usually been considered as synonyms and are so given by Laporte (1833, p. 144), Lacordaire (1857, p. 339), and E. Olivier (1886, p. 233). Since DeGeer has priority over Fabricius, most references to these species use the specific name *pennsylvanica.** Barber (1951, p. 18) states flatly that *pennsylvanica* and *versicolor* are not synonyms, and on p. 17 he designated the latter species as the *typus generis of Photuris* Dejean Motschulsky (III, 1854, p. 60) gives *lineaticollis* as perhaps a synonym of *trilineata* Say, and Lacordaire (1857, p. 339) said Laporte described only the variety of *pennsylvanica* which Dejean called *lineaticollis.* This gives some idea of the confusion between the very similar species in this group in the genus *Photuris.*

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*As actually used, "*pennsylvanica*" may cover several species other than *versicolor.*

Barber apparently believed that the Swedish word translated as "prairies" by DeGeer referred to fresh-water marsh land as he found his specimens in such a habitat, and states that its type locality is probably a former marsh area now within the limits of the city of Wilmington, Delaware. He states that it is a small species, 9.0 to 10.0 mm long; Specimens here considered to be *P. versicolor* are usually definitely larger than this, up to 18 mm long. Since the Swedish language has definite words for marsh and swamp, it would seem odd if Acrelius did not use such words in his correspondence with DeGeer; prairie would be a better translation of the words for field and meadow. Hesselius, also writing from the Wilmington vicinity in 1711, speaks of meadows and forests as habitats of the fireflies.*

As noted in my comments on Barber's paper (pp. 54-65) a species giving the distinctive two-component flash of *P. pennsylvanica,* as described by Barber, has not been noted among the photurines around Wilmington. It has, however, recently been collected by Dr. James E. Lloyd at Oneida, N. Y., both over fields and near a marsh. By far the commonest species of *Photuris* around Wilmington is the one giving a three- to six-component flash, called by Barber (with some doubt) *P. versicolor* Fabr. While this species is most densely prevalent along streams it is by no means confined to such localities and may be found in great numbers flitting around trees and over fields at some distance from any appreciable amount of water. The specific name *versicolor* is highly appropriate for the species here considered to be the Fabrician species, while the *P. pennsylvanica* collected in New York by Dr. Lloyd is fairly constant in coloration, is relatively small as compared with *versicolor,* and gives the flash described by Barber for *pennsylvanica.*

I believe Barber's question as to the identity of *versicolor* may be disregarded, that the species here recognized by that name is the Fabrician species, and is a distinct and valid species.

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FRANK ALEXANDER McDERMOTT (1885-1966)

In bygone days it was not unheard of for physical scientists to be amateur naturalists, but few achieved professional distinction in both fields. In the recent death of F. A. McDermott we have lost a classic example of this now very rare species: a man who spent a full and productive life as a chemist and microbiologist; then, in fifteen years of industrious retirement, built an early interest in fireflies into a position as a world authority on the taxonomy and natural history of the Lampyridae.

Mr. McDermott was trained as a chemist, first at George Washington University, then at the Mellon Institute of the University of Pittsburgh, where he received his B.S. in 1913 and M.S. in 1914. His professional career included six pre-college years in the Hygienic Laboratory of the U. S. Public Health Service, four in the fermentation laboratory of the Corby Co., and 32 years with E. I. du Pont de Nemours & Co., Inc., in Wilmington, Delaware, during the last 24 of which he was chief chemist of their Deepwater industrial alcohol plant. His activities in these posts are attested by a score of published papers and notes on fermentation, general chemistry, and laboratory instrumentation, by 13 U. S. patents (10 assigned to the Du Pont Company) of processes related to organic acids and oils and commercial production of glycerol, alcohols, and resins, by his membership in various professional societies and by his reception of the Thobald Smith Medal at the 3d International Congress of Microbiology (1939) and a Modern Pioneer award of the Philadelphia Chamber of Commerce and

National Association of Manufacturers at the commemoration of the 150th anniversary of the U. S. patent system (1940).

Though born in Washington and resident there during high school and early adult years, Mr. McDermott came from colonial New England stock and his early interest in biology may have stemmed from boyhood collecting in the Thoreau-saturated environment of the family home in Concord. Whatever the reason, he found ample encouragement in natural history among his professional superiors in Washington and his friends in the Smithsonian, Department of Agriculture, and U. S. National Museum. One of the most influential of these early associations in turning McDermott's attention to bioluminescence was that with H. S. Barber, a lifelong field companion and friend. McDermott's first note on fireflies appeared in 1910, and before he moved to Wilmington in 1918 he had published on the chemistry, histology, and physics of firefly luminescence as well as the related subjects of chemiluminescence and electric illumination, and, in a long series of behavorial notes, established the importance and significance of firefly flashing signals in mating.

When McDermott took up his career as a DuPont chemist he must have viewed the move as marking the end of his love affair with the firefly, for he presented to the Smithsonian several books and bound volumes of separates dealing with bioluminescence, some stamped "Biofotogenesis Library of F. Alex. McDermott". Indeed for the next 30 years no contribution to lampyridology issued from his pen. But the ferment must have been working, for in 1948, two years before his retirement, the privately printed "Common Fireflies of Delaware" appeared. In 1951 he edited and supplemented Barber's 58 page posthumous monograph on the genus *Photuris,* in which flashing signals are boldly made an essential part of the specific descriptions. In the same year McDermott visited Jamaica to gain the field experience he felt to be essential to complete his definitive treatment of the "Lampyrid Fireflies of Jamaica" (1959), a 112 page work long delayed by the slowness of the junior author.

Meanwhile a steady stream of taxonomic and behavorial notes was issuing from the well appointed laboratory McDermott set up in his suburban Wilmington home. In these descriptions of new species and genera (eventually totalling 20), in the study of samples from individuals and museums all over the world, and in wide readings in modern theoretical genetics, evolution, and systematics, McDermott laid the foundations for his major contributions to the taxonomy of the genus Pyractonema (24 pp., 1960), the taxonomy of the Lampyridae in general (72 pp., 1964), and his culminating 149 page revision of the Oliver treatment of the Lampyridae (Pars 9, Junk-Schenkling Coleopterorum Catalogus), a copy of which arrived in Wilmington on the day before his death. Mr. McDermott's collection was willed to the Academy of Natural Sciences of Philadelphia, where he spent many happy hours.

In the long reach of history it will not matter what sort of human being was this man who has so advanced our knowledge of fireflies, but as the representative of his many friends, it is pleasant to be able to pay tributes to his old-school gentlemanship and delightful humor, his catholic interests in the world about him (ranging through gardening and conservation to the aurora, mushrooms, continental drift, songbirds, and hawks), his altruistic activities and concerns in education and science (embracing bibliographic format, long years of activity in the Society of Natural History of Delaware, toiling for Biological and Chemical Abstracts, simplified spelling, lecturing to school children) and his warm home life with his devoted wife of 57 years (who predeceased him by two months) and two daughters.[1]

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[1] Mrs. Earl D. Krapf and Mrs. William D. Eaton, both of Wilmington. I am particularly indebted to Mrs. Krapf for supplying most of the biographical material used in the above account and for preparing the bibliography.

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LOCALITIES FOR COLLECTING IN MEXICO

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INTRODUCTION

In this paper we provide notes on some particularly interesting localities visited during an extensive collecting trip in Mexico, in the course of which we visited all of the Mexican states except Baja California. (Fox, 1963 presents valuable information on collecting in Baja California). Also included is some general advice for collectors. This trip extended from July 1965 to September 1966, and was supported by National Science Foundation Grant GB-3312. Our objective was to obtain a working collection of Carabidae to form a base for a revision of the Mexican species of this family.

Ball's family rented a house in Mexico City (the choice of locale being determined by schools and other facilities), and from this base we made trips usually of about 30 days duration to specific areas.

Our vehicle was a ¾ ton Ford truck chassis, 4-wheel drive, with a 14 foot cab-over camper mounted on it. The camper was equipped with a propane stove, a ten gallon water tank, electric lights running off the battery, bunks, a table, cupboards and closets. We also carried two extra 6-volt batteries to operate our blacklights, extra water, and an extra ten gallons of gas in two five-gallon metal gas cans, mounted on the back bumper of the camper.

References we found useful are cited at the end. The maps we used are listed under MAPS in the reference section. The most complete road atlas is the "Guia" (1963). The map of Mexico and guide book published by the American Automobile Association are useful.

GENERAL INFORMATION AND ADVICE

To save space, statements in this section are dogmatic. However, we do not claim to be experts for our experience is limited. We will be glad to furnish additional information, on request.

FOOD.—In general, we avoided restaurants, subsisting instead on meals that we prepared. Most larger Mexican towns have supermarkets where one can buy a fair variety of canned goods as well as other food. We found it most convenient to stock up on all but perishable goods in Mexico City sufficient to last each trip.

White bread can be purchased from grocery stores in most towns, and is about the same as white bread in the north. "Bimbo" is a popular brand, and there are several others. Local bakeries provide very good hard rolls called "bolillos," as well as other breads and pastries.

Representative prices for canned goods bought in Mexico City are as follows: meat dishes—from $0.26 (pork and beans) to $1.43 (ham); vegetables—from $0.21 (tomatoes) to $1.00 (carrots); juices—$0.13. A large box of salt crackers costs $0.45 and filled cookies are $0.60 per two pound box. Bread is about $0.25 per loaf. Fresh bacon is about $0.50 per pound and eggs are about $0.50 per dozen. We spent about $3.50 per day for food for two.

ALCOHOLIC BEVERAGES.—Beer costs about $2.06 per case (24 bottles), if bought directly from a distributor rather than from a food store. Rum, tequila, and mezcal are about $1.00 per liter.

WATER.—We bought purified water, about $0.16 for 20 liters. Most of the smaller towns do not have this commodity, so carry a good supply. Frequently, soft drink bottling plants sell pure water.

HEALTH.—Keep yourself and your eating utensils clean. If you eat in restaurants, avoid uncooked food, such as salads. Carry insect repellent and use it regularly, especially in the tropics. The repellent "Off" repels not only biting Diptera but chiggers and ticks. It is available in Mexico but only in the larger centers. Take a supply with you. Carry a supply of "Halazone" tablets to purify water. Carry a standard first aid kit plus a supply of some potent pain killer, such as morphine.

CAMPING.—We camped by the roadside, but always a fair distance from the nearest town on the hypothesis that the probability of being robbed varies directly as the number of people likely to pass the vehicle. The farther one is from town the fewer are the passers-by. We had no trouble. We were always careful to leave a clean campsite, meaning that we buried the garbage and other refuse. We urge others to do the same.

ROADS, CARE OF VEHICLE, AND DRIVING.—The main highways in Mexico are good, two-lane, paved roads. In the vicinity of Mexico City are divided 4-lane highways. Many of the gravel roads are in good condition, but there are many very rough roads, especially in the mountains.

Use the best grade gas—"Pemex Cien." It is in yellow pumps at gas stations, and is generally available. The next best is "Gasolmex," in green pumps. Have your vehicle greased and change the oil regularly. Carry with you chains for the tires, tow chain, shovel, saw, axe, an extra fan belt, and battery jumper cable, as well as standard tools.

In general, confine driving to the daylight hours, and proceed with caution. Most of the country is open-range and there is an abundance of livestock with a penchant to stand in or stroll across the roadways. In small towns, drive slowly. Try to avoid driving in or through Mexico City.

On rough and rocky mountain roads, drive slowly, and by slowly we mean three to five miles per hour. If you intend to frequent the back country, be sure to have heavy-duty tires—at least two-ply heavier than you normally use.

In the event of car trouble, do business with the nearest small mechanic shop ("taller mecanico"). Chances are, you will get a good job done at a reasonable price. The larger garages are to be avoided. Tires cannot be repaired at gas stations, but must be taken to a "vulcanizadora."

In cities, keep your vehicle locked, and at night park it under a street light (this advice is good for any large city anywhere).

Be sure to have an insurance policy that is valid in Mexico. This can be purchased at the border. Car insurance is expensive, but necessary.

THE LAW.—Be well within it. Always have your entry papers with you. Don't get in trouble, but if you do, try to get to a lawyer before the police get to you. The basis of the legal system in Mexico is Napoleonic law which means that the accused must establish his innocence.

"GETTING ALONG WITH THE NATIVES."—In general, Mexicans are friendly and in the country they are unabashedly curious. Wear a smile rather than a gun and be courteous to passers-by. For a few pesos, the curious who stop to visit are glad to provide assistance. We found some excellent collectors this way.

NOTES ON COLLECTING

IN LITTER.—Collecting in litter can be a very frustrating business, yet may also be exceedingly productive. Very thin, dry litter in arid areas *(Acacia)*, especially if worked before the heat of the day becomes excessive, can produce surprisingly large numbers of beetles; no special equipment is required other than nimble fingers. In wetter areas, where leaf litter is fairly thick, one should look particularly for places strewn with the remains of pulpy, many-seeded fruits. Beetles of wide variety tend to congregate in such areas, notably carabids and staphylinids.

The "drowning" or litter washing method described by Darlington (1961) can be a very efficient means of extracting the macrofauna from thick litter under certain circumstances—a reasonably rich and dense fauna, and a nearby source of water. At one locality (32.5 miles east of Comitan, Chiapas) we found a dry, abandoned water trough meeting these requirements; its dimensions were about two meters square. After carefully sifting through all of the litter by hand that had accumulated in the bottom of the trough, we carried the litter to a nearby impoundment and washed it. This little experiment about doubled the take, and clearly demonstrated that even quite large insects (e.g., *Notiobia*) can easily be otherwise overlooked.

When sifting through litter, one is well advised to use tough, rawhide gloves. These greatly reduce trouble with biting or stinging animals and thorns and spines—all of which may be plentiful in all types of forests, particularly in the lowlands.

ON MOUNTAIN TOPS.—We visited a number of the higher peaks, including Orizaba and Colima as described later. In general, the carabid fauna diminishes rapidly as one approaches tree-line. On Orizaba, only one carabid was found above 13,000′, though a species of the silphid genus *Pteroloma* was abundant to the extreme edge of the ice fields. (For a clear account of the geological history of the great Mexican volcanoes see Clausen, 1959.)

IN MARSHES.—The marsh fauna generally seemed remarkably poor as well as difficult to collect. At one exceptionally productive (for Mexico) marsh, 31.8 miles east of Escarcega, Campeche, we found 18 genera and at least 26 species of carabids, but fared not nearly so well anywhere else.

IN BROMELIADS.—During most of the dry season, by far the most productive method of collecting was through the harvesting of arboreal bromeliads. (Strangely, the giant bromeliads of the rain forests harbored very few beetles.) The predominant carabids represented in the bromeliads of arid lowlands were of the tribe Lebiini, whereas at higher elevations, especially in such wetter forests as the mossy woods, the Agonini took over.

For example, from the bromeliads in a single tree in dry tropical deciduous forest (22.0 miles east of Jalapa, Veracruz, 1000′) we found 13 species and 192 specimens of Lebiini, no agonines, and two species and 16 specimens of other carabids. From a single tree in an elfin woodland area 12.0 miles south of Sola de Vega Oaxaca, 7100′) the totals were 3 species and 9 specimens of Lebiini, versus 8 species and 194 specimens of Agonini. At an intermediate sort of locality (an oak-pine forest, 34.5 miles north of Pochutla, Oaxaca, 4700′) the results were: Lebiini, 50 specimens of 7 species; Agonini, 174 specimens of 10 species; and others, 3 specimens of 2 species.

All of the above collections were made in March. By way of comparison, the 7100′ locality mentioned above, was revisited in July. Although the ground fauna had by then improved enormously, the bromeliad fauna was very poor; in two trees we found only 13 carabids, or about 3% as many per tree.

Techniques for collecting the bromeliads varied depending on specific circumstances. Probably the most generally efficient method was to cut down the trees. But often, the bromeliads could be most easily collected by climbing the tree, using ropes or driving in spikes if necessary. After they were harvested, the bromeliads were torn apart on a beating cloth, and the beetles collected immediately to prevent flying (particularly important in hot, dry areas). Because many of the bromeliads had very spiny tips and others housed scorpions, the use of heavy duty gloves was sometimes advisable. The bromeliads were quite productive for many other kinds of beetles, notably lagriids.

DURING THE DRY SEASON (November to May).—Aside from bromeliad work, collecting at this season is almost hopeless. A few habitats are relatively unaffected; the species of the riparian fauna, for instance, seem to be active year-round. The season when precipitation is reduced ("dry" season) occurs at the same time throughout the country. In the early part of the year, collecting was poor even in the wettest sorts of forests at all elevations.

AREAS VISITED

These are listed by the state in which they occur, alphabetically, and geographically within each state. Distances are in miles, from the nearest edge of a town. The point of reference for the edge of a town is usually the sign post bearing the name of the town.

The names of the forest types are from Leopold (1959) and from Beard (1944 and 1955). Beard (1944) provides a useful key to the tropical American forest formations.

CHIHUAHUA.

THE ROAD TO CREEL.—Few roads suitable for vehicles are found on the eastern slopes of the Sierra Madre Occidental. One of these is the road to Creel. This joins the main highway west of the city of Chihuahua (Route 16), from the south, at about the sign post for Kilometer 166. The road, which leads to Miñaca, is poorly marked.

Proceed through Miñaca on a road which crosses the railroad tracks, to the east of town. The road crosses a grassland mesa, descending into a wooded valley (oak-pine), at the bottom of which is an old hacienda, "San Pedro," 4.9 miles south of Miñaca. The road crosses the river continuing south on another grassy mesa. The road forks 7.2 miles south of Miñaca. Take the right fork. A pine forest is entered 14.2 miles south of Miñaca, the road traversing a valley to the Mesa de los Pozos. The road proliferates here into a number of seemingly equally good roads—all go to the same place. At 16.9 miles south of Miñaca, a forestry checking station is reached. Turn right, past the station. The road descends into a steep-walled canyon with a stream at the bottom which must be forded. Across the stream, the road traverses a side canyon in which the creek must be crossed about 16 times. At 28.6 miles south of Miñaca, the road forks. Stay to the left. We continued beyond this point for another 7.4 miles, and then turned back.

The road traverses open meadows, dry pine-oak woods, wet aspen-fir-Mexican pine forest, and wet mountain meadows, rising from 6400′ at Miñaca to a high of 8200′. There is excellent cover and collecting in many places along the way, especially in the rolling grassland 1.0 miles south of Minaca. At 31.9 miles south of Minaca (8100′, just over the crest) is a rich mountain meadow (at margin of corn fields); the adjacent slopes, clothed in aspen-fir-Mexican pine forest, were burnt over in 1963 but not destroyed though ground cover was badly damaged.

CHIAPAS.

PALENQUE (RUINS) AND VICINITY.—Palenque is located about 130 miles southeast of Villahermosa, Tabasco. A new road, almost complete (paved in places, otherwise good gravel) starts from the eastern side of Villahermosa and extends to Escarcega, Campeche. Palenque is south of this road. Ask for directions in Villahermosa. The road passes through low, wet country mostly devoted to agriculture and totally ruined for collecting. However, about 59 miles southeast of Villahermosa (Kilometer 95) is some relatively undisturbed rain forest. The road to Palenque joins the main road at the town of Catazaga, marked by a truck inspection station ("caseta fiscal"). The ruins are in the hills flanking the Chiapas highlands, about 12 miles from the town of Palenque and at an elevation of about 400′. Ask for directions to the "Ruinas" in Palenque. Outside the gate at the ruins is a flat, grassy area suitable for camping, and within the enclosure is an area for swimming. Soft drinks and beer can be purchased near the museum.

Immediately at hand is some dense rain forest, with shaded valleys and fairly deep leaf litter on the ground. In general aspect, the flora and fauna here seem very similar to that found in the vicinity of Sontecomapan, Veracruz.

THE PUEBLO NUEVO SOLISTAHUACAN AREA.—The town of Pueblo Neuvo Solistahuacan (or simply Pueblo Nuevo) is located on the lower northern flank of the Central Highlands of Chiapas, on Route 195. It can be reached from Route 190 (Entrada Escopetazo, about 12.2 miles northeast of Chiapa de Corzo, Chiapas), or from Villahermosa, Tabasco. It is about 80 miles from the Route 190 junction, and about 110 miles from Villahermosa. The former road is better. During the dry season, the road is passable for all types of vehicles, but we do not recommend driving over it in a standard-type low-clearance American car.

In general, the country to the south of Pueblo Nuevo is rather dry, supporting pine-oak forest; wetter areas have been completely taken over by coffee plantations. To the north, with a decrease in altitude, the road passes through the remains of tropical evergreen forest. The Pueblo Neuvo area is interesting because here one finds on hill tops and ravines cloud forests or their remains, as well as relatively undisturbed pine-oak forest. We collected in the following localities.

23.6 miles south of Pueblo Nuevo, 4200′—tropical deciduous forest, on a dry, west-facing slope; bromeliads.

3.1 miles south of Pueblo Nuevo, 5400′—damp oak-pine-sweetgum forest, in a small valley; bromeliads.

3.1 miles north of Pueblo Nuevo, 5800′—pine woods near road; cloud forest on hilltop to east of road. The slopes are steep, and the cloud forest is above a corn field.

6.6 miles north of Pueblo Nuevo, 5100′—tropical montane forest in an east-facing, very wet ravine densely shaded and with steep sides; also on upper slopes, to about 5600′.

11.6 miles north of Pueblo Nuevo, 5100′—tropical montane forest (possibly "mossy woodland"), in a narrow, densely shaded, steep-sided ravine; trees with an abundance of moss and epiphytes; creek clear, cool, evidently permanent.

THE OCOZOCUAUTLA AREA.—North of Ocozocuautla, in the Atlantic drainage system are forested areas. The town of Ocozocuautla (labelled on some maps as Ocozocuautla de Espinoza) is located about 21 miles west of Tuxtla Gutierrez, on Route 190. The road to the north joins Route 190 on the western side of

Ocozocuautla (the junction is slightly west of a gas station on the north side of the highway). It passes over a ridge rising to about 3500′ and then descends gradually. We drove only 25 miles northwest of Ocozocuautla, and the elevation on the road at this point was 2400′.

The forests are being destroyed, but there seems to be an abundance of undisturbed areas on either side of the road. Dense oak forest with an abundance of epiphytic bromeliads grows at higher elevations, and this grades into tropical montane forest at lower elevations. We did not encounter any permanent streams along the road.

We camped just off the road 11.6 miles north of Ocozocuautla in the oak forest on top of a ridge which to the west descends precipitously into a forested valley with an intermittent stream in the bottom. In March, we had success collecting in the bromeliads. In June, the bromeliads were unproductive, but blacklight collecting was fairly good. At both times of the year, the forest litter was dry and the litter fauna very sparse.

RANCH NUEVO.—This is a local designation for an area about 6.5 miles east of San Cristobal de las Casas, on Route 190. A dirt road joins the highway on the south side near a fence marking the western border of a re-forestation zone. This road traverses a rather wet open pine forest. It is passable by vehicle for about a mile south of the highway. The road ascends a mountain and is an admirable foot trail.

The pine forest on the flats is replaced by an oak-pine forest on the lower portions of the mountain slope, and at higher elevations one encounters in depressions what seems to be an impoverished cloud forest formation (including abundant *Chiranthodendron*), the trees and shrubs with a rich covering of moss and deep litter on the ground. On the flats are small grassy meadows near the bed of a temporary stream. The elevation on the flats is about 7100′, and the top of the adjacent mountain is about 10,000′.

THE SAN QUINTIN AREA (Fig. 1).—This is in the midst of tropical rain forest, 16° 24′ N., 91° 20′ W., at an altitude of 707′. We stayed at a semi-permanent camp of the Comision Federal de Electricidad. The camp is located near the junction of the Rivers Jatate and Perlas, between the rivers. It was necessary to go in by plane, carrying all food and equipment for a two-week stay. We flew from San Cristobal de las Casas (round trip for two—$96.00). The town of Comitan, however, is a better point of departure because it is at a lower elevation; consequently, a plane can take off safely carrying a heavier load, and further, the air field is less likely to become fog-bound.

At San Quintin, the person in charge was Señor Gabriel Guilleron M., mailing address Comision Federal de Electricidad, Zona San Quintin, Avenida Central No. 125, Tuxtla Gutierrez, Chiapas. He speaks and reads Spanish, only.

The camp and the adjacent airfield are in a savanna. The larger part of the savanna is across the Jatate. Otherwise, the surrounding country is all tropical forest, undisturbed except that mahogany trees were removed. The canopy is more or less open, and the leaf litter on the forest floor is generally shallow.

To the east, across the Perlas, is Lake Miramar, a beautiful body of water with a sand beach. A good trail leads to the lake, extending through the forest. About a mile west of Lake Miramar is a much smaller lake, Miramar Chiquita; it is surrounded by a fine swamp forest.

To the west of the Jatate is a forested mountain range, the Sierra de Colmena.

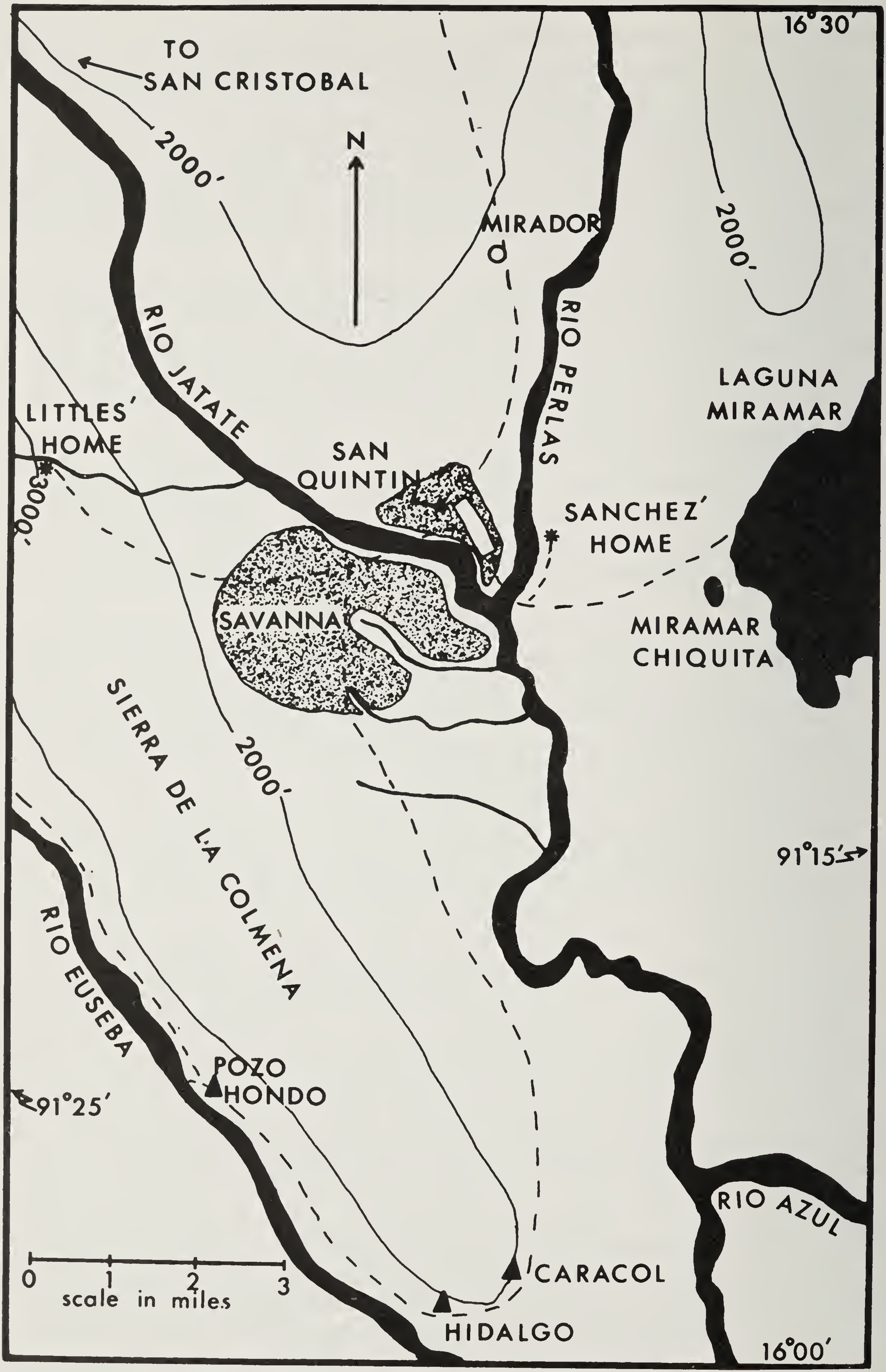

FIGURE 1. Map of the San Quintin, Chiapas area.

Legend: triangles—location of towns; stars—location of private houses; circle—location of Mirador, a lookout point; rectangle—air field at San Quintin; dashed lines—trails.

There are good but poorly marked trails to the Sierra; they cross the savanna and one should be accompanied by a guide because it is easy to become lost.

The rivers are quite different. The water in the Jatate carries a large quantity of red silt, whereas the Perlas water is clear. One finds sand or gravel banks along the Perlas, and clay or fine sand banks along the Jatate. In general, the banks are steep, the beaches are small and probably flooded during the rainy season.

Notes.—Although no one at the Electricidad camp spoke English, nearby were people who did. Señor Rudolfo Sanchez lives near the eastern bank of the Rio Perlas, directly across from the camp, and Enrique Little, his wife Juana and their daughter live on the slopes of the Sierra de Colmena, about five miles from the camp. These people know the area well and can provide a lot of useful information.

As a guide we hired an Indian, Señor Alonzo Sontez Comes, who lives at the southern end of the airfield. We hired Alonzo by the day, mainly to show us the trails. As long as one stays near the trails in the jungle there is little danger of becoming lost. A map of the area showing the trails can be purchased from Mrs. Franz Blom, Bibliotheca Fray Bartolomé, San Cristobal de las Casas, Chiapas.

We found the San Quintin area a delightful place to spend some time and recommend it highly to persons interested in the tropical biota of Mexico.

THE FRONTERA-COMALAPA AREA.—About 51 miles southeast of Comitan a gravel road from the south joins Route 190. This road, which is suitable for ordinary passenger cars, terminates at the town of Frontera-Comalapa (on most maps, simply Comalapa), about 11.6 miles from the junction with Route 190. The road passes through a range of low hills following the course of a small creek to its origin, and then descends into the valley in which Frontera-Comalapa is located. The hills are quite dry and the stream is intermittent. We collected in the following localities: (Mileages are north of Frontera-Comalapa.)

0.9, 2100′—semi-evergreen seasonal forest, mainly deciduous; in vicinity of a dry stream bed.

2.9, 2200′—cut-over evergreen seasonal forest.

4.9, 2400′—dry evergreen forest on a side road to Colonia Verapaz, with cacti and ground bromeliads in understory; limestone outcrops.

7.7, 2600′—oak forest, with acacia and ground bromeliads; soil predominantly dry, sandy loam, with some humus. A tropical deciduous forest grows above the oak forest, on the eastern side of the road. The oak forest is of very limited extent.

THE HUIXTLA-MOTOZINTLA ROAD.—This road is on the southern slopes of the Sierra Madre de Chiapas. It is gravel with a fairly good bed. Its worst feature is a very long, steep grade. The road joins Route 200 at Huixtla and probably ends at Motozintla (we did not drive to Motozintla).

The road passes through tropical evergreen forest, tropical deciduous forest, oak-pine forest, elfin woodland and finally, open meadows at about 6000′. The latter may be the result of clearing. The most interesting area we encountered with a patch of elfin woodland in a ravine and on a steep slope 33.7 miles north of Huixtla. The soil was very damp, under a fairly deep layer of leaf litter. The trees and rocks were covered with moss, and trees supported a rich growth of bromeliads. A small stream was in the ravine bottom.

COLIMA.

THE MANZANILLO AREA.—East of Manzanillo 12.8 miles, on Route 110 is a relatively undisturbed tropical forest consisting mainly of tall palm trees, probably of the genus *Dorbignya.* Dead palm fronds litter the ground. Unfortunately, we were able to spend only a couple of daylight hours here, and we obtained a poor but very interesting fauna. Black light collecting would probably be highly profitable.

DURANGO.

THE LA FLOR-LAS CEBOLLAS AREA.—These small communities are located in a range of mountains south of the city of Durango. Inquire in Durango for directions. The distance to La Flor is 50 miles; to Las Cebollas, 75 miles. The main road passes through La Flor, not to the west of it as indicated on some maps. The road is passable for a truck but is very rough. We drove continuously for seven hours to La Flor. From La Flor to Las Cebollas our time was about four hours. From grassland-desert in the vicinity of Durango, the vegetation changes gradually to scrub-oak-Manzanita woodland, to oak-pine woodland at higher elevations, and finally to pine-fir forests in protected canyons. The country is generally very dry but is wetter between La Flor and Las Cebollas. The elevation at La Flor is 8700′, and at Las Cebollas it is 7700′.

We had good collecting in two places. The better site was at Arroyo Hondo, elevation 7500′, to the east of the La Flor-Las Cebollas road, and about six miles south of La Flor. This canyon is northeast-southwest oriented and has a permanent cold, clear stream. The banks are gravel and rubble. The dominant trees are oak and pine but fir trees grow in small areas near the stream. A rather lush flora grows near the water; farther up the slopes it is drier and grasses take over in the understory.

The second site we collected at was 8.3 miles north of Las Cebollas, at 9100′. This is the highest point on the road. Fir and pine trees are dominant and it is generally a relatively damp area.

NOTES.—Located in this same range is a town called El Refugio, and we think we have good reason to believe that this is the "Refugio, Durango" referred to in the Biologia Centrali-Americana. Our evidence is that Refugio is the type locality of *Scaphinotus macrogonus* Bates and we collected specimens of this species at the sites mentioned above. These are the only known specimens of this species other than the type series and a single specimen labelled "Ciudad." Selander and Vaurie (1962) were unable to decide which of several "Refugio" localities in Durango was the one referred to in the "Biologia." We attempted to visit El Refugio but the road was blocked by a flooded creek.

GUERRERO.

OMILTEMI (OR OMILTEME) AND ENVIRONS.—This is one of the classic collecting areas in Mexico, located in the Sierra Madre del Sur.

The road to Omiltemi can be traversed safely by trucks, jeeps and possibly by Volkswagen sedans, but we think it is too rough for ordinary passenger cars.

The Omiltemi road joins Route 95 on the western side of Chilpancingo about 0.5 miles south of a tourist information center. At the junction is a small green building, a forestry checking station. The road heads due west, into the mountains. About 2.6 miles west of the junction, the road forks. Keep to the right. The road passes through a town 3.4 miles east of the fork and Omiltemi is about 12 miles beyond this town.

Originally a ranch (Goldman, 1951:152), Omiltemi is now a very small logging town. In the town, the road turns left rather sharply and proceeds up a forested slope, into a more or less cleared area about a mile from town. We camped here. It is possible to drive a mile or so farther, but the road becomes very bad. Distances noted below are miles west of Chilpancingo, unless otherwise specified.

8.4, 4900′—cleared and formerly farmed land, on steep slopes, probably near edge of what was once tropical deciduous and oak forest.

12.1, 6100′—open forest of oak, juniper and some palms.

13.9, 6300′—vicinity of ponds, in a rather narrow canyon: vegetation oak-pine-palm forest.

0.9 mi. e. Omiltemi, 6700′—in a narrow, heavily forested canyon with steep sides and a clear, cold creek; forest of pine and oak, with *Alnus* near creek.

About one mile west of Omiltemi, 7300-8000′—cloud forest consisting of various tropical trees, above oak-pine forest, on slopes of ravines; several tree ferns seen in one valley (Goldman, 1951:153 states that tree ferns were "plentiful"); good cover on ground, including deep leaf litter and logs; poison ivy in wet places.

JALISCO.

THE NEVADO AND VOLCAN DE COLIMA.—These peaks are reached from the vicinity of Atenquique, a small town west of Route 110, and south of Ciudad Guzman. Several roads lead to Atenquique. We approached from the north.

Drive through Atenquique on the main road. This turns left (at this point, a monument is on the right and a bus station is on the left), crosses a bridge over a river, extends through a park and continues straight across a traffic circle. A short distance past the circle, the road ascends a steep hill. Beyond the circle 1.5 miles, the road forks, the left leading to Tonila, the right to the mountains. From this point it is about 20 miles to the highest point on the road, about 10,000′, in the saddle between Nevado and Volcan. The road though basically smooth is steep in places and deeply rutted. We had to walk the last few miles because of a deep rut that we could not cross in the vehicle.

The cleared land at the base of the mountains gives way to dry oak-pine-madroño forests at lower elevations on the open slopes. In the more protected sites in the canyons through which the road winds, are stands of fir, and at higher elevations are oaks and alders covered with ferns and mosses. In the saddle between the peaks of the Nevado and Volcan, the forest is replaced by herbaceous vegetation, including willows and large lupines. The vegetation terminates at about 10,400′ on the south-facing slope of the Nevado.

We did not see any water on the mountain slopes, but we crossed a number of dry stream beds.

MORELOS.

THE CUERNAVACA PEDREGAL AND CANON DE LOBOS.—These areas are located along the paved Route 136, between Cuernavaca and Yautepec. This road joins Route 95 on the eastern side of Cuernavaca and extends across a lava field (pedregal). About 7 miles east of the junction, the road descends into and winds through Cañon de Lobos. The road is narrow but there are a few pull-offs on the north side of the road where one can park. At the bottom of the Cañon is a stream bed with flowing water during the rainy season.

The vegetation in these areas is tropical deciduous forest, with trees of many species, about 40′ high. Large organ pipe cacti are numerous. Leaf litter and soil are thin.

The best place we found on the pedregal was about 5.4 miles east of Route 95-136 junction. At this point, a small road leads toward a gravel pit (can be seen from the road) and ascends a small hill past the pit. We camped in this area.

In Cañon de Lobos, we camped 9.1 miles east of Route 95-136 junction, and collected along the stream bed directly below our campsite.

NUEVO LEON.

SANTA ROSA CANYON.—This canyon is west of Linares and is traversed by Route 60 (see Howden, 1966: 20, Map 1). At a point 14.8 miles west of Linares, a gravel road joins Route 60, enabling one to drive off the highway. A small cleared area is along this road between the highway and the creek bed. This is suitable for camping.

In the canyon bottom are sycamores, walnut trees and very large oaks supporting bromeliads. The steep canyon walls support a rich tropical deciduous vegetation. We did not find much here, but because the area looks very promising, we probably visited this area at the wrong times (October and early July).

OAXACA.

THE ROAD FROM OAXACA (CITY) TO VALLE NACIONAL.—This is an unnumbered road which can be reached either from the vicinity of Oaxaca to the south or from San Juan Tuxtepec, Veracruz, to the north. The most interesting areas are between Oaxaca and Valle Nacional, in the Sierra Madre de Oaxaca. The distance between these points is about 110 miles. The road is all-weather but is very rough, in places very steep, and often the bed is paved with large stones. It is wide enough for vehicles to pass without difficulty and there are pull-outs suitable for parking at frequent intervals. It is possible to cover the distance in a day of virtually continuous driving.

The road joins Route 190 from the north about five miles southeast of Oaxaca, about opposite a large monument to a great Mexican president, Benito Juarez. The road crosses one ridge at an elevation of about 8000′ descends to the Rio Grande valley, and then ascends again to the north of Guelatao, attaining a maximum elevation of 9200′. The descent to Valle Nacional (ca. 200′) is long, steep and treacherous.

From Oaxaca to Valle Nacional, the country becomes progressively wetter. The higher parts of the ridge between Oaxaca and the Rio Grande support oak-pine forests. Between Guelatao and Valle Nacional one passes through oak-pine forest to boreal forest at the higher elevations (9000′). At about the highest point on the road is a broad, lush meadow. Mossy or elfin woodland occurs on the ridge top also and on the higher parts of the northeastern slopes. It is replaced by cloud forest around 6000′, and this gives way to montane or tropical evergreen forest. In the vicinity of Valle Nacional, the forest is badly cut over.

The northern slopes of the Sierra Madre de Oaxaca are very steep and it is virtually impossible to work on them. We collected at the following points, indicated in miles south of Valle Nacional:

6.5, 2000′—a small flat area, suitable for camping, and environs, adjacent ridge top supports a stand of oaks.

16.9, 3600′—tropical montane forest in vicinity of a small pond.

27.5, 5600′—Mexican cloud forest (tree ferns, rich growth of moss, epiphytes); clear, swift-flowing creek.

32.8, 6200′—Mexican cloud forest, rich growth of epiphytes.

35.7, 6900′—oak forest on steep slope, with rich understory of shrubs.

38.2, 8200′—Mexican cloud forest, mainly broad-leaved trees, some pines; several creeks.

48.1, 8500′—seemingly rather dry oak-pine forest, on west-facing slope.

53.8, 8300′—pine forest and wet meadow.

60.6, 7400′—oak forest, grading into pine; rather dry.

64.5, 6500′—oak-pine forest, with many bromeliads.

72.5, 4100′—vicinity of Rio Grande.

88.5, 8000′—madroño-oak-pine woods, rather dry.

89.2 —dry oak forest, with some bromeliads.

97.3, 7900′—margin of agricultural land, in cut-over oak-pine woods.

Notes.—We recommend use of blacklights to collect in the tropical evergreen forest, and possibly molasses or simple pitfall traps in strategic places. Black flies in this area transmit onchocerciasis. Liberal use of repellent is therefore recommended.

THE OAXACA-PUERTO ANGEL ROAD.—This is Route 175 extending south from Oaxaca, across the Sierra Madre del Sur, to the Coastal village of Puerto Angel. The distance is about 116 miles of which the first 62 miles of road is paved. Beyond the town of Miahuatlan the road is rough and it required about 10 hours of continuous driving to reach Puerto Angel.

The road reaches a maximum elevation of about 8700′, five miles south of San Juan del Pacifico, passing from agricultural land at lower elevations to dry oak-pine forest on the northern slopes of the mountains. At higher elevations on the southern slopes, wetter forest is encountered, especially in protected valleys. In turn, drier oak-pine forest occurs on the lower Pacific slopes, and this is replaced by remnants of montane tropical forest in the upper reaches of canyons. The readily accessible parts of this plant formation are devoted to coffee. The montane forest is replaced by tropical deciduous forest on the Pacific coastal plain. We crossed streams at several places on both the northern and southern slopes of the Sierra.

We collected at the following localities between San Miguel Suchixtepec and San Pedro Pochutla. To the north of Suchixtepec and south of Pochutla it was too dry to find anything when we were there in March. All distances are given in mi. s. San Miguel Suchixtepec:

3.4, 7100′—wet canyon, well shaded, heavily wooded, upper slopes with pine and a more or less open understory; near clear, cold creek a dense, almost impenetrable tangle of shrubs among the tall alder bushes. A similar canyon was found at 10.6, 6800′.

18.4, 4500′; 19.1, 4500′; and 22.3, 4700′—east-west oriented canyons, wider and drier than those mentioned above, with streams in bottom, in oak-pine zone; bromeliads on trees.

22.5, 4700′—oak-pine zone, on steep upper slopes of a broad, dry canyon, to east of road; collected from bromeliads in oak trees.

23.4, 4500′—oak-pine zone; a small seep beside road, with moss on rocks.

36.7, 1400′; 38.4, 1100′; and 47.1, 700′—Cut-over tropical montane forest; collected from bromeliads and along streams.

THE OAXACA-PUERTO ESCONDIDO ROAD.—This road joins Route 175 about 10 miles south of Oaxaca and crosses three ridges of the Sierra Madre del Sur.

From the junction to Puerto Escondido the distance is 190 miles. The maximum elevation of the road is 7100′, attained 12 miles south of Sola de Vega. It is paved to the base of the first ridge, a distance of about 35 miles. The road is good for an additional 70.1 miles, to the summit of the third ridge, and is terrible for the next 85 miles. West from Puerto Escondido, a paved road extends along the coast. We followed it for only nine miles, but it may extend to Acapulco.

In general, the road traverses dry oak and oak-pine country but near the tops of the southern slopes of the ridge Mexican cloud forest is encountered and cut over montane tropical forest occurs at lower elevations on the Pacific slopes of the southernmost ridge. On the coastal plain is tropical deciduous forest as well as palm forest and mangrove swamp to the west of Puerto Escondido. We collected at the following localities:

42.7 miles south of jct. with route 175, 6100′—oak forest on steep, east-facing slope; bromeliads.

42.9 miles south of jct. with Route 175, 6000′—along margins of a small dry creek bed, bordered by corn field and a small stand of oak; good collecting under stones.

12.0 miles south of Sola de Vega, 7100′—cut-over Mexican cloud forest at top of a southeast-northwest-oriented canyon; Spanish moss and other bromeliads numerous; litter very dry in March but damp in July.

20.7 miles south of Sola de Vega, 4700′—oak forest, bordering a cypress stream, in an east-west oriented canyon; bromeliads; palmettos.

Rio Atoyac at Juchatengo, 2900′—along river and in grassy fields, near bridge.

15.4 miles south of Juchatengo, 5600′—oak-pine forest on steep slopes of a small canyon; bromeliads; black flies numerous in March.

20.9 miles south of Juchatengo, 6300′—wet oak-pine forest on steep slopes; Pacific drainage.

22.2 miles south of Juchatengo, 5800′—montane tropical forest, in west-facing, steep-sided ravines; water in creeks cold; understory dense; leaf litter rather thin.

28.5 miles south of Juchatengo, 4200′—montane tropical forest in a deep, steep-sided ravine; water in creek bed; understory dense, numerous vines.

83.4 miles south of Juchatengo, 2100′—oak forest in midst of tropical deciduous forest; litter rather deep.

PUEBLA.

PICO DE ORIZABA (CITLALTEPETL).—The higher parts of this mountain are most easily reached from the west, from Route 144. It is possible to get to an elevation of about 13,000′ by road.

The road to the volcano joins Route 144 about 3.5 miles north of Ciudad Serdan, Puebla, at about a bearing of 45°. It is unmarked, and goes right through extensive corn fields. A drive of five miles brings one to Guadalupe Ocotengo. Drive through the town to the far side of the square and turn left. In 3.7 miles, one comes to Tlachichuca, and here directions to San Miguel Zoapan should be asked for, as well as directions for crossing the town. East of Tlachichuca 2.4 miles is an old hacienda, and the road forks here. Bear to the left. The road passes between the hacienda and a field in which are standing the remains of small stone buildings, probably once the houses of field workers. From the hacienda to San Miguel Zoapan the distance is 4.0 miles. At the entrance of the town, the main road terminates in a cross road. Go left here, around the town. The town of San Miguel Hidalgo is 2.8 miles further. Here, ask for directions to "El Volcan," or better still, ask for Manuel Lopez, who, for a small fee, will guide you to the mountain (Señor Lopez is an affable, intelligent individual. Although he speaks only Spanish, for the benefit of foreigners he does so clearly and slowly). From San Miguel Hidalgo to the end of the road the distance is 5.3 miles. At the end is a hut belonging to the "Legion Alpina de Puebla." A foot trail leads up the mountain to the snow fields.

In general, the road is terrible beyond the hacienda mentioned above, and should not be attempted without a rugged, high-clearance vehicle.

To an elevation of about 10,500′, the country is generally devoted to agriculture but between the hacienda and San Miguel Zoapan along a dry stream bed, is a stand of pine forest, and above 11,000′ is open pine forest with fir stands in the more protected sites. On the northwestern side of Orizaba, the forest extends to an elevation of about 11,800′. The herbaceous vegetation above tree line consists mainly of a species of grass (zacatal?) on gentle slopes and flat places, with small clumps of *Juniperus*. On steep slopes, and above 13,000′, the continuous carpet of vegetation ceases and small herbs and lichens grow among the rocks. At 15,000′ is the end of a snow field from which issues a stream.

QUERETARO.

THE ROAD TO PINAL DE AMOLES.—This road extends from Route 85, south of Huichihuayan, San Luis Potosi, to San Juan del Rio, Queretaro, ascending the eastern slopes of the Sierra Madre Oriental. We drove from the eastern terminus only as far as the summit of the ridge known as Pinal de Amoles.

The road passes through the remains of tropical evergreen forest (vicinity of Xilitla), oak-pine forest, desert, temperate deciduous forest, and pine forest. A number of streams are crossed. We collected at the following sites:

9.6 miles east of Xilitla, 1400′ and 6.0 miles west of Xilitla, 3000′—banana and coffee plantations.

24.7 miles east of Landa de Matamoros, 5000′—sweet gum forest with some oak, pine and alder, on steep, north-facing slope; stones covered with moss.

17.8 miles east of Landa de Matamoros, 5300′—oak-pine forest with madroño; understory of grasses and herbs; lots of cover—litter and logs.

Landa de Matamoros, 3400′—open field with grasses and herbs, beside road; acacia bushes.

Rio Jalpan, near Jalpan, 2600′—clear stream with gravel and rubble banks; large cypress trees near water.

6.4 miles east of Pinal de Amoles, 6000′—at base of a steep slope along margins of a forest of tall, straight oaks, on damp ground near a small creek bed.

2.2 miles west of Pinal de Amoles, 8300′—near or on summit of mountain, cutover pine-oak forest; meadows; soil damp.

SAN LUIS POTOSI.

EL SALTO.—Howden (1966:21 and Map 2) describes the El Salto area. He does not mention, however, the *Sabal* palmetto forest which is along the El Salto Road, within a half mile of its junction with Route 80. We obtained here, in October, under the dead palm fronds on the ground, a larger number of carabid species than anywhere else in Mexico. However, collecting was poor in July, when we visited the area for a second time.

TAMAULIPAS.

THE VILLA DE CASAS-LA PESCA ROAD.—This is one of the few roads to the coast between the Rio Grande and Tampico. About five miles south of Ciudad Victoria, a road going east to Villa de Casas joins Route 85. To Villa de Casas (or Casas on some maps), a distance of about 27 miles, the road is paved, and is on flat terrain. Beyond Casas, the road is not paved but is wide and well surfaced to about 10 miles west of Sota la Marina. From here to the Rio Soto la Marina, the road follows the telephone line, is narrow and tortuous. The river, which must be forded, is wide and over two feet deep. The town of Soto la Marina is on the far bank of the river. Ask in town for directions to La Pesca. The road beyond Soto la Marina is terrible. Near La Pesca, the outlet of a lagoon must be forded.

As far as Villa de Casas, one sees only agricultural land. Beyond Casas, the road crosses the Sierra de Tamaulipas attaining an altitude of about 1500′ and passes through some interesting low tropical semi-evergreen forest. Beyond Soto la Marina, the vegetation is mainly tropical deciduous, but about 10 miles from the coast is a band of fine thorn forest, the best we saw in Mexico. Some trees in the thorn forest support small bromeliads.

The shore at La Pesca is sandy-clay, with a thin covering of shells. The beach itself is only a few feet wide and immediately behind it is a continuous mat of vegetation, consisting mainly of grasses. Presumably the barrier beach to seaward is sandy. We did not investigate this, but it should be possible to rent a boat at La Pesca, should one want to do so.

THE SIERRA DE GUATEMALA AND FIELD STATION OF TEXAS SOUTHMOST COLLEGE.—This mountain range is to the west of Route 85, between Ciudad Victoria and Ciudad Mante. Two roads ascend the eastern slopes, one from the town of Gomez Farias and one from El Encino. The latter road is the better and is used by logging trucks. It is the only road going west from El Encino. This town is on Route 85, between the turnoff to Gomez Farias and Llera.

About three miles west of El Encino the road crosses the Rio Sabinas on a causeway and forks shortly thereafter. The left fork heads up the Sierra. Under the best of conditions, this is a hazardous road and is best not attempted in a vehicle lacking 4-wheel drive. It is possible to arrange for a ride in a logging truck. After a drive of about two hours, a small logging town is reached. The road passes through the town and turns left and terminates six miles from here (more than an hour of driving time) at the field station, elevation about 3800′.

This mountain range has on it the northernmost stands of Mexican cloud forest in the east. The climate and vegetation are described in detail by Martin (1958. Note—the Encino road is not on Martin's map). At present, Texas Southmost College operates a field station on the old Rancho del Cielo, a site made famous in the scientific literature by Aaron Sharp, George Sutton, Dwain Warner, Byron Harrell, Richard Robins and Paul Martin, with the aid and cooperation of the late proprietor of the ranch, W. Frank Harrison. The college welcomes visiting scientists to its field station. For details, write to Mr. C. J. Garland, President, Texas Southmost College, Brownsville, Texas.

Our collecting was confined to the forest in the vicinity of the ranch.

VERACRUZ.

THE SONTECOMAPAN AREA.—The town of Sontecomapan (Sontecomatlan on some maps) is located at the base of the San Andres Tuxtla Mountains. It is reached by the road which is along the north shore of Lake Catemaco and is about 10 miles northwest of the town of Catemaco (see Howden 1966: 22 for details). The gravel road is in fairly good shape. Beyond Sontecomapan, the road passes through more or less cut-over tropical evergreen or rain forest, but 2.5 miles west of Sontecomapan, on the right side of the road near a small clearing and rather swift-flowing stream is a small patch of relatively undisturbed forest. The forest extends up-slope, along the stream. Downslope, the creek turns east, toward Sontecomapan, and flows eventually into a lagoon. Along the margin of the lagoon is some wonderful undisturbed swamp forest in water about two feet deep, but with dry leaf-covered hummocks here and there. About 4.2 miles farther northwest along the road, one encounters relatively undisturbed forest, but on very steep slopes. The road was impassable beyond this point.

THE CANYON OF THE RIO METLAC.—This canyon is located between Orizaba and Fortin de las Flores, off Route 150. The entrance to the road into the canyon is on the northeast side of the bridge named "Puente San Miguel". A power plant of the Cerveceria Moctezuma is about two miles from the highway and is located in a lovely park beside the Rio Metlac. It is possible to camp here, but permission must be obtained in advance from the manager of the station, Ing. Camilo Gomez Correa, Planta Hidro-Electrico, Sumidero, Veracruz.

The vegetation of the canyon is tropical montane forest, but sycamores grow along the river. Much of the canyon floor has been cleared, but not all of it and there is plenty of forest on the steep canyon walls. Collecting was excellent here from August to January, but for the latter part of the winter into early summer, we found few insects.

At the head of an adjacent canyon to the west is a waterfall in a large cave. This is interesting to see, and one walks through cloud forest or elfin woodland to get there.

ADDENDA

1. The destruction of lowland forests in Mexico is proceeding at an incredible rate. For example, the patch of rain forest 2.5 miles west of Sontecomapan, Veracruz, described above, was almost totally destroyed between June, 1966 and August, 1967, and large portions of the palm forests near Manzanillo, Colima were destroyed in about the same interval of time.
2. Regulations currently in effect require individuals collecting biological material in Mexico to have permits. See "The Pan-Pacific Entomologist", 43(1): 87-88 (1967) for relevant details.

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POSSIBLE MIMICRY BETWEEN CERTAIN CARABIDAE AND CHRYSOMELIDAE[1]

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The Italian entomologist Silvestri (1904) was one of the first to recognize interrelationships between the Carabidae and Chrysomelidae. He recorded the development of larval stages of the ground beetle, *Lebia scapularis* Fourcroy, which require for food the pupal stage of the galerucine beetle, *Pyrrhalta luteola* (Muller). Balduf (1935) credited Rosenberg for noting that the larvae of *Lebia cruxminor* L. feed upon those of another galerucine, *Adimonia tanaceti* L. Van Emden (1942) recorded similar associations but asserted that ". . . it will, indeed, be impossible to identify full-grown larvae of species of *Lebia (L. scapularis* Fourcroy) which are semiparasitic on beetle pupae."

To the best of my knowledge, the striking similarity between adult beetles of these two families has not been recorded. Nevertheless, resemblances have been pronounced enough that specimens of both families, from the same locality and date of collection, have been confused in museum collections. Do these strong superficial likenesses represent cases of aggressive mimicry on the part of the predator carabids, or are these cases of either Batesian or Mullerian mimicry? Further study is needed to determine which organisms serve as models, as mimics, and as the deceived receptors of these mimetic signals.

Balsbaugh (1966) recorded having collected a single specimen of the ground beetle, *Lebia furcata* LeC., along with a large series of the alticid, *Disonycha alternata* LeC., by beating *Salix* sp. (willow), three miles east of the "Y," Macon county, Alabama. The similarity of body coloration and elytral vittae between these two species is most remarkable (fig. 1). *Disonycha alternata* LeC. has also been associated with *Lebia depicta* Horn by V. M. Kirk, who indicated on his specimen labels that the latter species was feeding on the larvae of the former. Kirk collected these beetles at Riverhead, Long Island, New York, July 1, 1948, on "beach plum."

A third carabid-chrysomelid association of vittate species involves the ground beetle, *Lebia depicta* Horn and the alticid, *Disonycha procera* Casey (fig. 2). These beetles were collected by R. L. Post in Bottineau County, North Dakota, August 28, 1961.

Associations of immaculate species were noted July 12, 1966, when two specimens of the ground beetle, *Lebia pumila* Dej. and a single specimen of *L. viridis* Say were taken along with twenty-three specimens of the cryptocephalid, *Lexiphanes saponatus* (Fab.). This series was collected by sweeping *Apocynum cannabinum* L. (dogbane), seven miles southeast of Parker, Turner County, South Dakota. The closeness of these resemblances is not as pronounced as in the vittate species, and the similarity of *Lebia pumila* Dej. and *Lexiphanes saponatus* (Fab.) (fig. 3) is greater than that of the latter with *L. viridis* Say.

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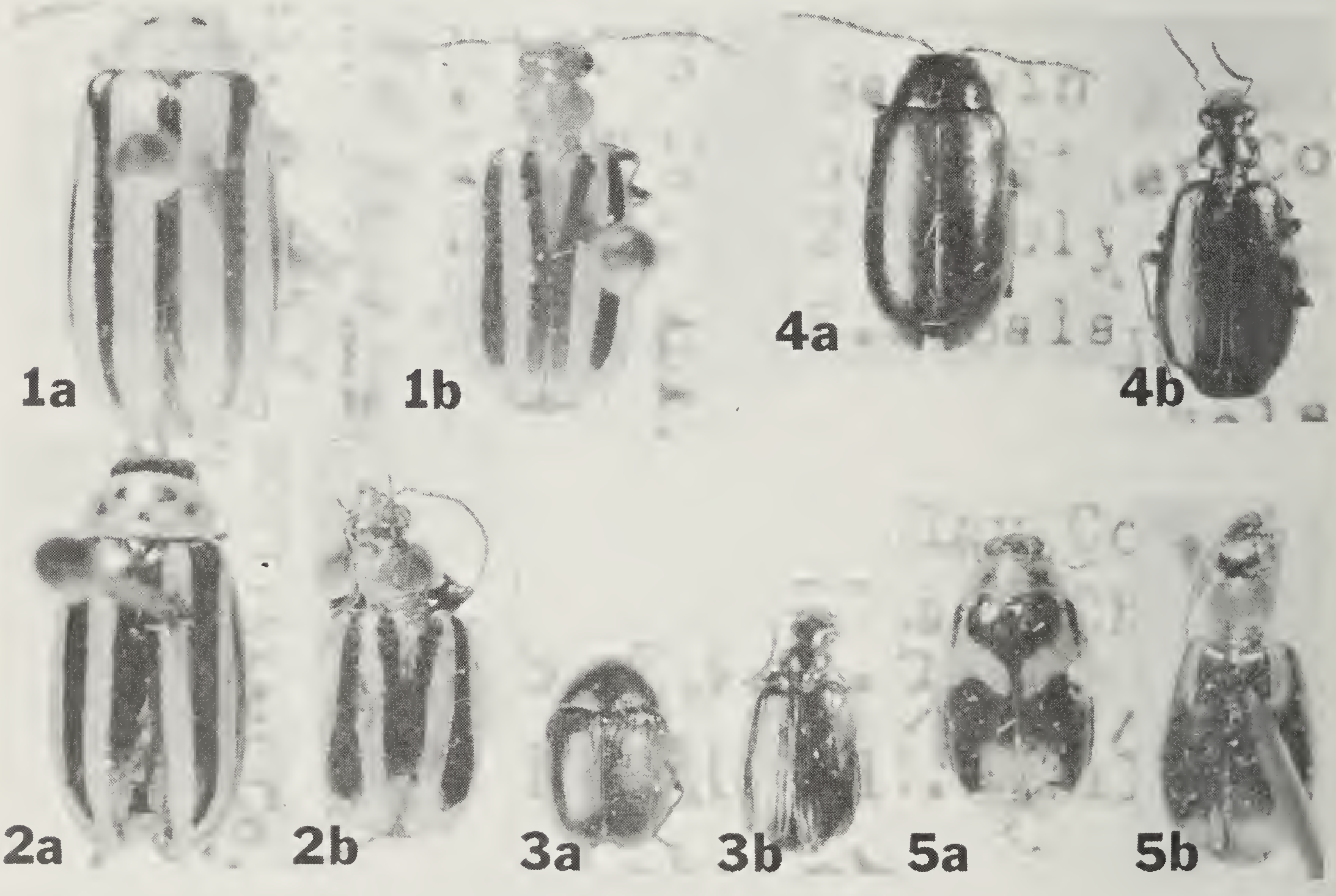
[1] Approved by the Director of the South Dakota Agricultural Experiment Station as Journal Series No. 765.

Suspected associations, for which substantiated field observations are yet lacking, possibly occur between *Lebia viridis* Say and various *Altica* spp. (fig. 4).

Lebia analis Dej. and the alticid, *Capraita obsidiana* (Fab.), are also possibly interracting species. They occur sympatrically in Alabama and are nearly as remarkable in elytral patterns and colors as are the vittate species. Both of these beetles have varying elytral patterns of fuscous and black (fig. 5).

It is to be hoped that other coleopterists will be encouraged to note similar ecological associations when collecting, or otherwise studying in the field. Often clues to such relationships can also be discovered when working in the laboratory with pinned specimens.

Acknowledgments: I wish to sincerely thank Dr. Kirby L. Hays, Auburn University, Auburn, Alabama, for the loan of specimens, and Dr. Vernon M. Kirk, United States Department of Agriculture, Northern Grain Insects Research Laboratory, Brookings, South Dakota, for the loan of specimens and assistance with references.



Figures 1a, b—5a, b, Mimetic associations of Chrysomelidae (a's) and Carabidae (b's). 1a—*Disonycha alternata* LeC., 1b—*Lebia furcata* LeC. 2a—*Disonycha procera* Csy., 2b—*Lebia depicta* Horn. 3a—*Lexiphanes saponatus* (Fab.), 3b—*Lebia pumila* Dej. 4a—*Altica foliaceae* LeC., 4b—*Lebia viridis* Say. 5a—*Capraita obsidiana* (Fab.), 5b—*Lebia analis* Dej.

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A NEW SPHENOPHORUS FROM ARIZONA AND DISTRIBUTIONAL NOTES (COLEOPTERA: CURCULIONIDAE)

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The species described below becomes the tenth member of the *simplex* group of species (Vaurie, 1951, p. 61). It agrees with them in small size, lack of raised pattern; long, not apically widened beak; eyes extending below level of insertion of beak; mesepimeron with straight front margin and acuminate outer margin; peduncle of postmentum flat, narrowly sulcate, rounded in front; front coxae virtually contiguous, middle coxae narrowly separated; tarsi with third segment narrow, longer than wide, below glabrous except for sparse hairs at sides.

At first sight this small species, as well as *Sphenophorus imus* Gyllenhal and *subulatus* Chittenden, look like large species of *Sitophilus,* but the mesepimeron and scutellum differ, and *Sitophilus* have the front coxae as widely spaced as the middle ones, and the apices of the tibiae furnished with pincer-like spurs.

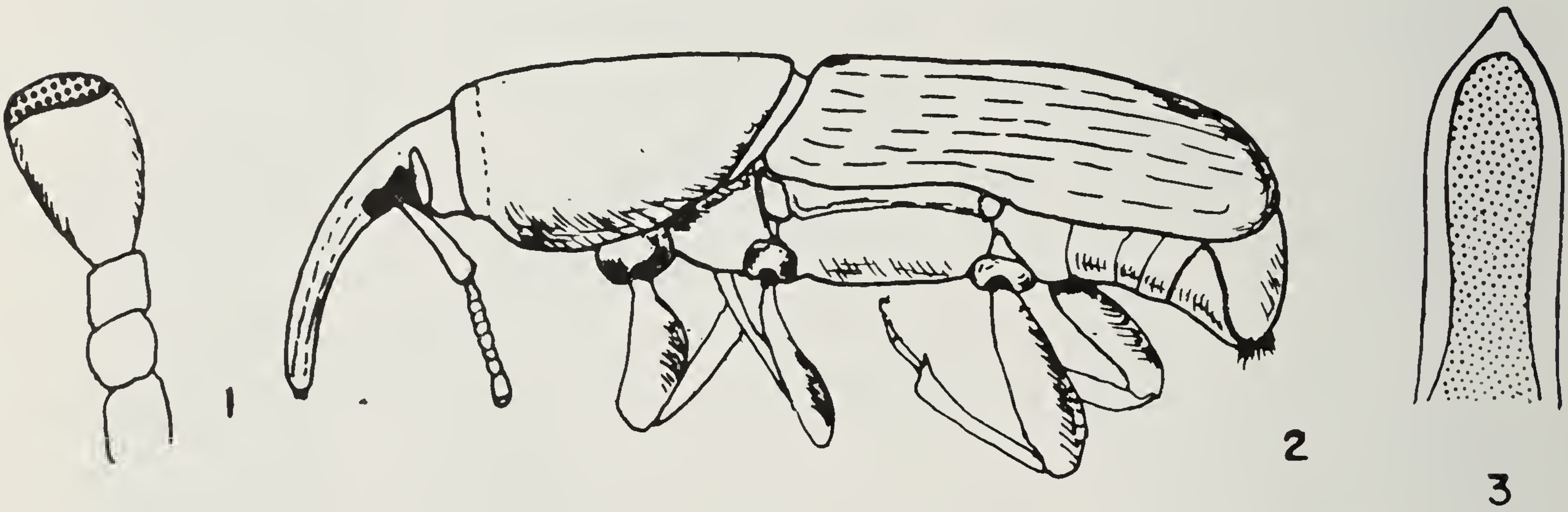
Sphenophorus caroli Vaurie, New Species
(Figs. 1-3)

Holotype, male, Patagonia, Santa Cruz County, Arizona, July 6, 1958, Charles W. O'Brien, collector, taken "inactive under dry cow dung," and 17 male and 12 female paratopotypes. Holotype and some paratypes in the American Museum of Natural History, some paratypes to be deposited in the collection of Charles W. O'Brien, University of California, Berkeley, some in the United States National Museum, the British Museum (Natural History), and the Naturhistoriska Riksmuseum, Stockholm.

Diagnosis: Very similar to *imus* and *subulatus,* but differing from them and from others of *simplex* group by having smaller spongy apex on antennal club (scarcely visible in some individuals), narrower eyes (not wider than length of adjacent apical collar of pronotum), shorter scape, generally smaller size, and aedeagus of slightly different shape. Shining, polished, appearing black to unaided eye, but pale or dark red under lighted microscope.

Description of Holotype, Male: (characters of group given above, not repeated) Length, 6 mm. *Beak* shorter than pronotum, slightly arcuate, nearly cylindrical; in profile rather flattened and somewhat narrower toward apex, with vague keels on sides near upper and lower contours, extending from apex to about antennal scrobe; similar keel on top of beak; apex beneath not angulate; scrobe proportionately large and deep (fig. 2), opening close to eye. *Antennal club* scarcely dilated toward apex, more or less barrel shaped in profile (fig. 1), spongy apex so small as to be barely visible; scape short, bulbous toward apex, not longer than funicle. *Eye* narrower in width than antennal club. *Pronotum* longer than wide, finely, sparsely punctate, but a dozen much larger punctures at middle of base. *Scutellum* convex, elongate, no wider than sutural interval, sides nearly parallel. *Elytra* only about one-third longer than pronotum, strongly ribbed; intervals more or less flat, with single row of minute punctures; striae on disc deep, some as wide as one-third of width of interval, punctures within striae indistinct, punctures of outer striae larger, not impressed; apices truncate. *Under surface,* prosternum and legs finely, sparsely punctate, remainder with larger, deeper punctures. Metasternum and first abdominal segment hollowed out at center, punctures with short hairs visible, last abdominal segment also with short hairs, but not depressed; femora bulbous, not hairy within; tibiae on inner side slightly sinuate, with sparse, inconspicuous hairs, front tibia on outer side slightly incurved, with outer apical angle slightly prolonged, inner apical spur incurved, larger than spurs of other tibiae; front and middle coxae on inner face with tuft of four or five hairs. *Pygidium* convex, apex truncate, with small tufts of hairs at sides, rather regularly punctate. *Aedeagus* slender, apex acuminate but not needle-like (fig. 3), aedeagus with lateral line present.

Variation from Holotype: Size ranges from 5.5 to 7 mm. Females differ from males by having no ventral cavity, venter being rather convex, and a relatively longer, stouter inner apical spur on the front tibia. Some of the paratypes of either sex have smaller punctures at the apex than at the middle of the pygidium, but there is no well defined line of demarcation as there is in some species of the *simplex* group. The bending inward of the tibiae is stronger in some individuals; the vague keel on top of the beak is not noticeable in some specimens; many males have the apex of the abdomen strongly bent under.



FIGS. 1-3—*Sphenophorus caroli* Vaurie, new species. 1—Antennal club. 2—Lateral view. 3—Apex of aedeagus.

Remarks: This species is named for the curculionid specialist, Charles W. O'Brien, of the University of California at Berkeley, who collected the type series.

Although this species is very similar to *imus* with the same kind of beak with large antennal opening, the same kind of elongate, finely punctate pronotum, narrow, parallel-sided scutellum, deeply ribbed elytra, and small size, it differs in the club, eyes, and scape as stated above in the Diagnosis, and also by having the apices of the elytra truncate, not separately rounded, the inner spur of the front tibia longer and stouter, the top of the beak vaguely carinate, not smooth, and the pygidium without a distinct raised area of finer punctures at the apex contrasting with the other, larger punctures. The male differs further from the male of *imus* by having only short, thin yellow hairs on the venter, not thick white hairs, no extensive oval patch of thick white hairs on the apex of the abdomen, and only a narrow tuft of hairs on the coxae, not a large mass of hairs covering half the coxae. The aedeagus of the two species is of the same sort, but the apex in *imus* is distinctly needle-like; that of *caroli* is more similar to that of *subulatus, gentilis,* and *quadrivittatus* in having a suggestion of a knob at the apex. Both *caroli* and *imus* have been collected in Patagonia, *imus* also elsewhere in Arizona and in Mexico.

The few specimens (seven) of *subulatus* examined (New Mexico, Arizona, Texas-Mexico border) differ from *caroli* in some of the same characters as for *imus* (club, eyes, scape, pygidium, top of the beak), and further by having a distinct depression at the apex of the abdomen in both sexes, the pronotum less elongate, and the male with the venter glabrous, without hairs.

In my key to the species of *Sphenophorus* (Vaurie, 1951, p. 55), this species may be placed before couplet 30 which keys out *simplex, mormon, subulatus,* and *imus,* as follows:

Antennal club with spongy apical part on outer side no more than one-fifth of length of club; eye no wider than length of apical collar of pronotum—*caroli*

Antennal club with spongy apical part on outer side one-third of length of club; eye wider than length of apical collar of pronotum..

Distributional Notes

A few extensions of range for species of *Sphenophorus* are given below to supplement other changes made previously (Vaurie, 1954, 1956).

Sphenophorus aequalis ochreus LeConte: This subspecies is recorded from as far north as northern Utah and Nevada; it occurs also in southwestern Idaho as shown by a specimen from Parma, July, 1931, collected by Lanchester and in the collection of Charles W. O'Brien, University of California, Berkeley.

S. a. aequalis Gyllenhal: No specimens have been reported between the Dakotas and the state of Washington although they have been reported from north of the border; now we have ten specimens from 10 miles south of Choteau, Teton County, Montana, June, 1962, on Prairie Grass, *Puccinella nutalliana,* in the collection of Mr. O'Brien.

S. angustus Boheman: The range of this species is extended southward of Chihuahua, Durango, Hidalgo, and San Luis Potosi, Mexico, by two specimens, one from Lagoa do Moreno [Lagos de Moreno], Guanajuato, March, 1962 (Halffter and Pereira) in the Departamento de Zoologia, Sao Paulo, and one from 8 miles west northwest of Apizaco, Tlaxcala, June, 1961, taken on the University of Kansas Expedition.

S. arizonensis Horn: This Arizona-New Mexico species was known from only one specimen from Mexico (Distrito Federal), but there are now two more from Km. 60, Carretera Mexico to Jalapa via Texcoco, October, 1961 (Pereira and Halffter) in the Departamento de Zoologia, Sao Paulo.

S. cicatristriatus Fahraeus: An extension of the range slightly farther east than North Dakota is shown by two specimens in the collection of Mr. O'Brien from Clay County, western Minnesota, and another state of Mexico, Queretaro, can be added to Jalisco, Guanajuato, and others (specimen, June, 1952, taken by Gilbert and MacNeil and in the University of California at Berkeley).

S. hoegbergii Boheman: A male from Tampico, Tamaulipas, March, 1951 (Stephen) in the University of Kansas, Lawrence, is the second specimen to be recorded from Mexico (the other was from Veracruz) of this Arizona-Texas species.

S. incurrens Gyllenhal: The range from Mexico to Panama should now include to Honduras (a male from Progreso, March, 1923, collected by T. H. Hubbell in the University of Michigan).

S. pertinax peninsularis Chittenden: The east coast range of this subspecies was recorded as Florida north to Georgia. A specimen from farther north was collected by Ashlock at Wrightsville Beach, New Hanover County, North Carolina, in the collection of Mr. O'Brien. It was taken from *Spartina alterniflora,* a new host plant for the species, although the nominate subspecies occurs in another plant of the same genus *(cynosuroides).*

S. phoeniciensis Chittenden: In Mexico recorded from the states of Sonora and Jalisco, and now from Nayarit (San Blas, 1953, collected by Borys Malkin). In the U. S., Nevada (Las Vegas) may be added to Arizona and California.

S. pontederiae Chittenden: This species, which breeds in the fresh water pickerel weed, has not been reported previously on the east coast north of Georgia, but I have seen a male in the collection of the University of Missouri from Providence, Rhode Island.

S. venatus vestitus Chittenden: This widespread subspecies of the eastern and southeastern U. S. and Greater Antilles has now been seen from Chicxculub, Yucatan, Mexico, July, 1952 (J. and D. Pallister) in the American Museum of Natural History. The subspecies *reticulaticollis* Boheman occurs in central Mexico.

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RHYSODIDAE: Would like to borrow for revisionary study, material from Central, and South America, and the West Indies. P. Francisco S. Pereira CMF, Departmento de Zoologia, Caixa 7172, São Paulo, Brazil.

The Coleopterists' Bulletin

A QUARTERLY PUBLICATION DEVOTED TO THE
STUDY OF BEETLES

VOLUME 22, 1968

DEPARTMENT of ENTOMOLOGY
PURDUE UNIVERSITY
LAFAYETTE, INDIANA 47907

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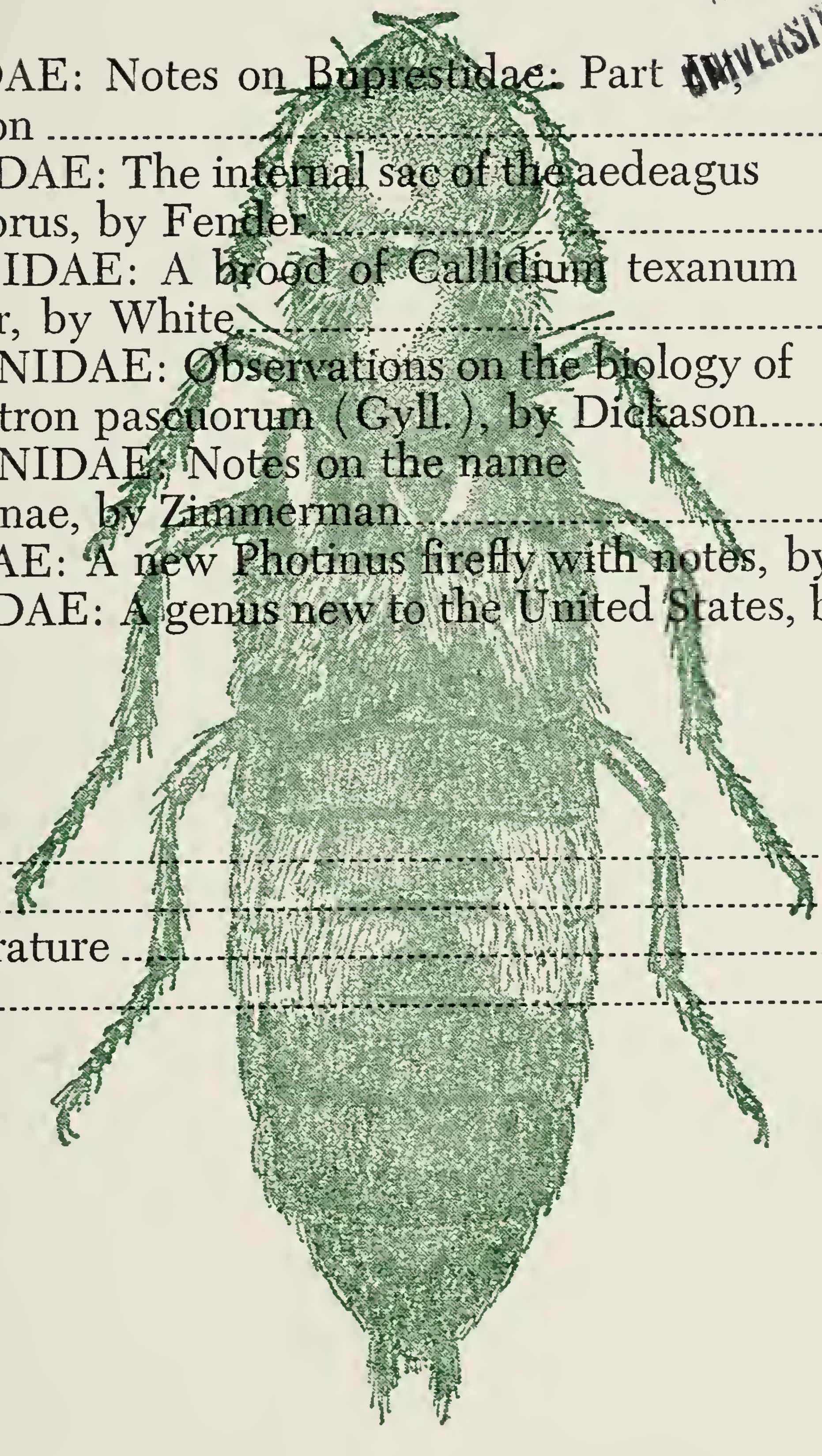

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VOLUME 22 MARCH 1968 NUMBER 1

DEPARTMENT of ENTOMOLOGY
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THE COLEOPTERISTS' BULLETIN

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THE COLEOPTERISTS' BULLETIN
VOLUME 22 MARCH 1968 NO. 1

A New Photinus Firefly, with Notes on Mating Behavior and a Possible Case of Character Displacement (Coleoptera: Lampyridae)

James E. Lloyd[1]
University of Florida

The mating behavior of most Nearctic *Photinus* has been described (Lloyd, 1966a). Since that investigation a new species, a sibling of *Photinus pyralis* (Linnaeus), has been discovered and studied, and additional observations have been made on a photinid that was only briefly observed during the above study.

Methods, materials, and equipment used here were described in the report cited above.

Photinus concisus Lloyd, NEW SPECIES

BEHAVIOR: The deme studied was on an oak hillside in deep weeds and over the edge of an adjacent lawn in Kerrville, Texas. Observations were made between 31 May and 6 June, 1966.

Male flashing activity began between 18 and 27 minutes after sunset, continued at a high level for about 20 minutes and then slowly diminished. By one hour after sunset only an occasional flashing male was seen.

Males usually fly about one meter above the ground and during each flash (flash pattern = single flash) fly in a short arc. Arcs are usually in the horizontal plane, but upward or downward arcs (vertical plane) are sometimes executed. During each flash 10-20 cm. are traversed and between flashes 30-100 cm. Late in the activity period males generally fly 2-4 meters above the ground, and cover much longer distances during and between flashes. Flashes of several males were compared to flashes of an electronic flasher and appeared to be 0.3-0.4 seconds in duration at 74°F. Flash pattern interval varied slightly with temperature (72°, range 1.9-3.0, $\bar{x} = 2.3$, $n = 16$; 76°, range 1.7-2.4, $\bar{x} = 2.1$, $n = 6$).

Females were found on vegetation within one meter of the ground. They responded to the flashes of males and the flashlight with single-pulsed flashes at short delays. The flashes of one recorded female averaged 0.58 seconds in duration and were emitted at an average delay time of 0.57 seconds at 73° (Tables 1 and 2). Male approaches to females were observed; two to five flash exchanges took place during approaches.

A deme of *pyralis* in the same site was also observed. This species began activity 15-20 minutes earlier than *concisus* and its peak activity ended a few minutes after *concisus* began. Female delay time in *pyralis* has been previously reported for individuals collected in eastern United States (McDermott, 1911; Buck, 1937;

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[1] Formerly Research Associate, Museum of Zoology, the University of Michigan.

Lloyd, 1966a). Females from Kerrville behave similarly. Three were timed with a stopwatch and their delays at 73° were 2.0, 2.1, and 2.3 seconds. Eight were recorded electronically (Tables 1 and 2).

Table 1

Species	Locality	Female No.	Temp. (F°)	Mean (Sec)	Range (Sec)	s.d.	n
concisus	Kerrville	1	73	0.57	.48-.62	.036	23
"	"	2	73	0.50	.48-.54	.020	11
"	"	4	73	0.67	.63-.70	.030	5
"	"	3	73	0.57	.51-.62	.032	10
"	"	5	73	0.55	.48-.63	.035	18
pyralis	"	1	76	2.08	2.05-2.12	.035	3
"	"	2	76	2.11	2.05-2.21	.062	6
"	"	3	76	2.02	1.90-2.11	.108	3
"	"	4	76	2.25	2.10-2.45	.110	9
"	"	5	76	2.16	2.03-2.23	.069	7
"	"	6	76	2.28	2.28-2.28	—	2
"	"	7	76	2.23	2.04-2.41	.121	10
"	"	8	76	2.12	2.05-2.22	.091	3
dimissus	Jarrell	1	76	0.17	.14-.21	.014	55
"	"	2	76	0.23	.22-.24	.010	3
"	"	3	76	0.20	.17-.22	.014	12

Table 1. Female Delays. Delays are timed from the start of stimulus flashes to the start of response-flashes. Artificial flashes used to stimulate females were similar in duration to flashes produced by males.

Because the male flash lengths of *pyralis* and *concisus* are similar, if not identical, and there is time and space overlap in their activity, captive females of both species were closely observed to determine whether or not cross-specific signalling occurs. Nine *pyralis* females in glass cages were arranged in an arc at 0.5 meter intervals. They flashed in response to the flashes of both *pyralis* and *concisus* males but attracted only *pyralis* males. *Concisus* males either continued in the direction they had been traveling, turned and flashed again and then flew off, or turned and flashed several times before flying away. Seven *concisus* females were tested in a similar fashion. They responded to flash patterns of males of both species and attracted several *concisus* males, but no *pyralis* males. One *concisus* female was placed in an arc with five *pyralis* females. All females responded to *concisus* males, and within a period of five minutes two were attracted to the *concisus* female. None were attracted to the *pyralis* females. This last test was conducted late in the evening, and no *pyralis* males flashed over the females.

It is unquestionably the female time delay that keeps males from coming into physical contact with sibling (i.e. heterospecific) females. Although there is a difference in the activity time of males of the two species, females of *pyralis* continue to flash-respond long after most of their males have ended their activity and

TABLE 2

Species	Locality	Female No.	Temp. (F°)	Mean (Sec)	Range (Sec)	s.d.	n
concisus	Kerrville	1	73	0.58	.28-.76	.124	23
”	”	2	73	0.50	.39-.56	.051	11
”	”	3	73	0.84	.60-.96	.134	10
”	”	4	73	0.67	.20-.72	.207	5
”	”	5	73	0.47	.24-.64	.103	18
pyralis	”	1	76	0.34	.32-.36	.020	3
”	”	2	76	0.34	.29-.38	.033	6
”	”	3	76	0.39	.35-.41	.032	3
”	”	4	76	0.30	.25-.45	.061	9
”	”	5	76	0.46	.36-.51	.055	7
”	”	6	76	0.44	.39-.48	—	2
”	”	7	76	0.36	.22-.54	.096	10
”	”	8	76	0.45	.42-.48	.030	3
dimissus	Jarrell	1	76	0.38	.08-.84	.191	55
”	”	2	76	0.29	.20-.36	.081	3
”	”	3	76	0.47	.28-.78	.145	12

TABLE 2. Female Flash Lengths. Artificial flashes used to stimulate females were similar in duration to flashes produced by males.

they do answer *concisus* males. On the other hand, *concisus* females never answer flashlight flashes or *pyralis* males during the first 20 minutes of *pyralis* activity.

DIAGNOSIS: *P. concisus* has previously been confused with *Photinus pyralis* (Linnaeus). Male flash pattern emitted about every two seconds (versus about every six seconds in *pyralis*). Female response-delay about 0.6 seconds in duration (versus about 2.2 seconds in *pyralis*). Antepenultimate tergite entirely black (Figure 1) (versus with translucent (usually appearing white, cream, or pink) lateral edges in *pyralis*) (Figure 2). Ratio of total width of pronotal lateral margins (flanges to pronotal width greater than 0.31 (versus less than 0.31 in *pyralis*) (see below regarding geographic variation of this character). Lateral explanate margin of pronotum flat (versus with a ridge immediately mesal the submarginal row of punctures in *pyralis*)[2]. Entire surface of ventral segment 5 entirely black or brown (Figure 3) (versus with a variable translucent-yellow apical margin in *pyralis*) (Figure 4). Pits on pronotal lateral explanate margin numerous and closely spaced (versus pits relatively sparse in *pyralis*). Less constant characters are 1) the coloration of the penultimate tergite, usually completely dark in *concisus* and with translucent (appearing white) lateral borders in *pyralis,* 2) the coloration of the pygidium, usually with fuscous-translucent areas in *concisus* and with translucent or yellow-translucent areas in *pyralis,* 3) the pink coloration of the hypomera usually confined to the hypomera in *concisus* and extending irregularly upon the pronotal flange in *pyralis,* and 4) the coloration of the mesepimera, black in *concisus* and fuscous-or black-orange in *pyralis. P concisus* vouchers are, on the average, 0.7 mm. (male) and 0.8 mm. (female) shorter than their Kerrville *pyralis* voucher counterparts.

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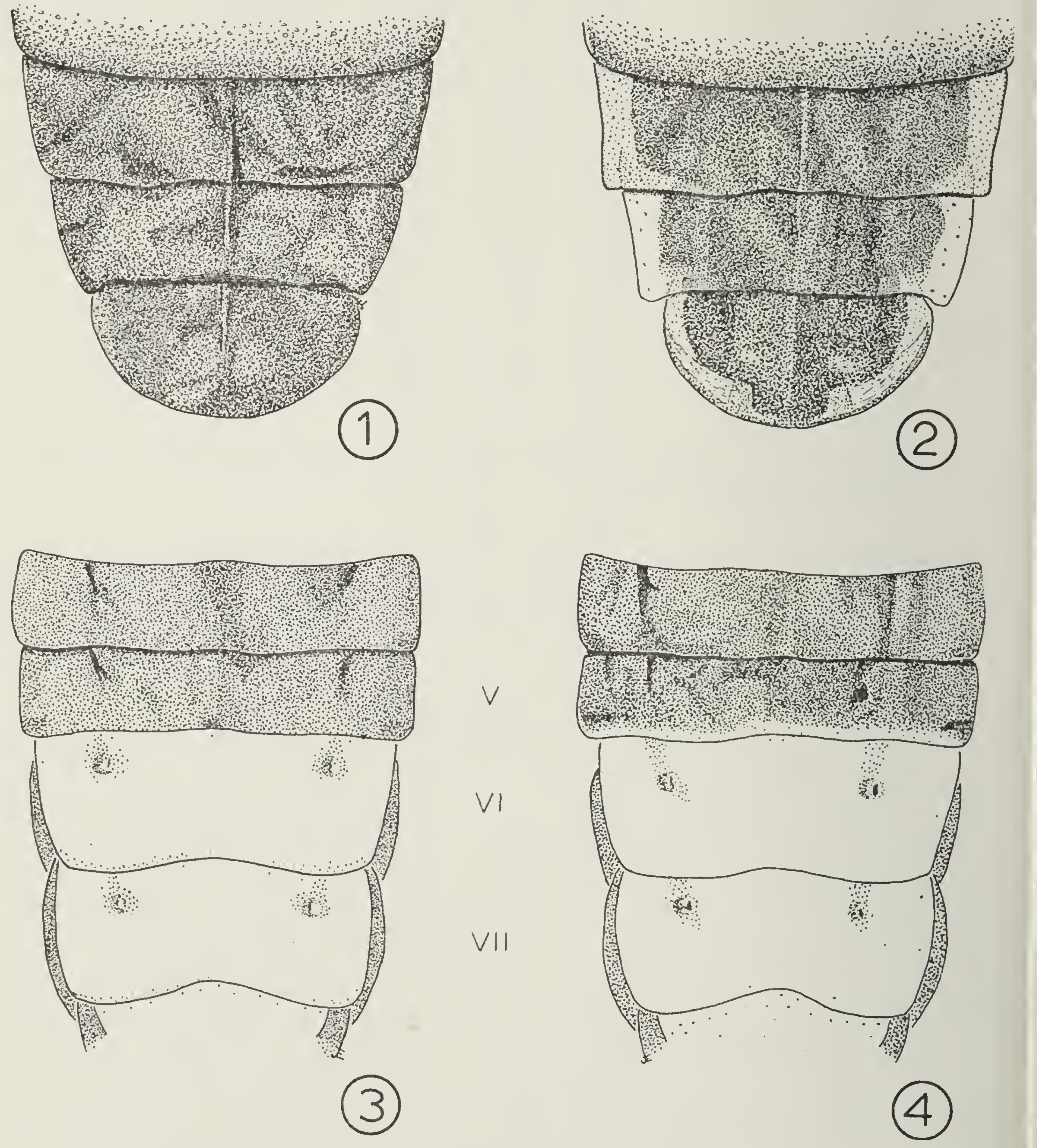
[2] This ridge is most obvious if the specimen is viewed dorsally with rays from a microscope lamp passing across the pronotum at a low angle.



Figures 1-4. 1. Abdominal tergites *P. concisus* n. sp. 2. Abdominal tergites *P. pyralis* (Linnaeus). This character is the most consistent morphological character. The figure shows the usual condition. The slightest indication of a translucent area at the lateral edge of the antepenultimate tergite will identify the specimen as *pyralis* (male only). 3. Ventral abdominal segments *P. concisus* n. sp. 4. Ventral abdominal segments *P. pyralis* (Linnaeus). Pale margin variable, sometimes lacking.

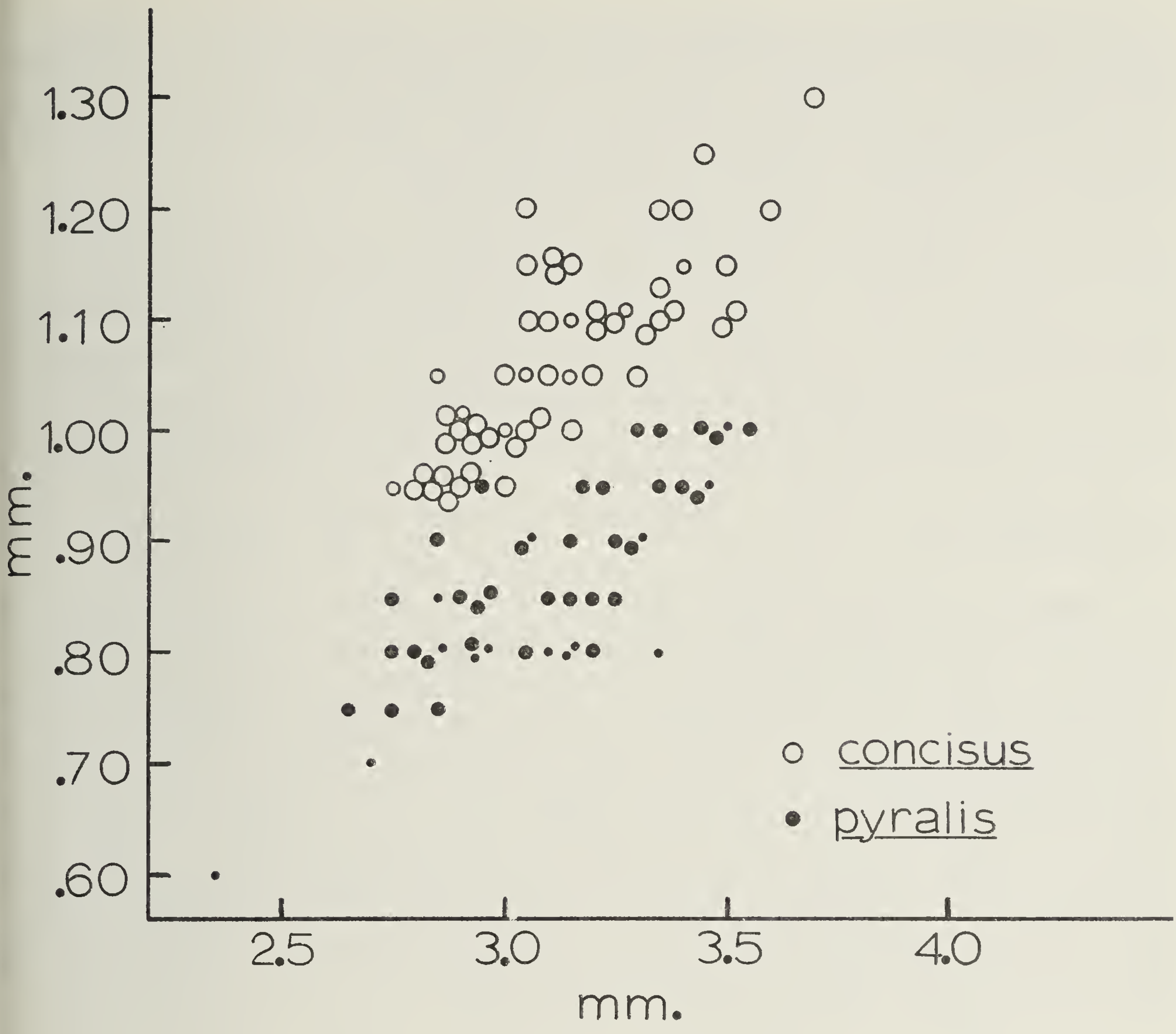


FIGURE 5. Pronotal proportions of behavior voucher specimens of *pyralis* and *concisus* from Kerrville, Texas. Small symbols indicate females. Horizontal axis = pronotal width, vertical axis = combined width of pronotal lateral explanate margins. Note the nearly complete separation.

HOLOTYPE: Male. Form as in *pyralis* (see Green, 1956). Length 11.5 mm. Eyes large, separated above by less than diameter of eye. Pronotum without central dark spot; with central, rectangular, glossy rufous spot; with numerous closely spaced pits (excluding central raised disk); with total width of pronotal lateral explanate margins 0.36 width of pronotum; with pink pigment of hypomera only slightlv and irregularly extending upon ventral surface of pronotal explanate margin. Scutellum and mesonotal areas fuscous and rufous, respectively. Elytra black; sutural bead yellow; lateral explanate margin yellow, becoming fuscous and black apically. Mesepimera black. Ventral abdominal segments 2-5 entirely black, 6 and 7 yellow and luminous, 8 yellow with translucent areas, 9 fuscous. Dorsal surface of penultimate and antepenultimate segments entirely black. Pygidium rounded, brown with small fuscous-translucent area each side. Aedeagus as in *pyralis* (see Green). Flash pattern a single flash about 0.4 seconds in duration; emitted about every two seconds of flight.

TYPE LOCALITY: Texas: Kerr County, 1 mile NE Kerrville on Route 16. 1 June, 1966. J. E. Lloyd. Dry hillside over weeds and adjacent lawn in oak grove. Lloyd No. 6679; one of thirteen specimens collected singly by hand on the above date after flash pattern interval was timed with a stopwatch. Deposited in the collection at Cornell University: C. U. Type No. 4411.

VARIATION: Length 9.3-12.5 mm. Four specimens have a fuscous central pronotal spot. See Figures 5 and 7 for variation in pronotal proportions. Ventral surface of pronotal explanate margin usually without pink pigment; pigment usually confined to hypomera. Scutellum fuscous or yellow. Yellow elytral border nearly absent in some specimens and covers only the bead; in others it is wider than explanate margin. Sutural bead fuscous or with narrow yellow line. Pygidium entirely black, with black "T" surrounded by fuscous translucent cuticle, or with a fuscous-translucent margin. Penultimate segment dorsally occasionally with lateral fuscous areas.

FEMALES: Length 8.9-10.7 mm. Alate, similar to males in form and coloration. Eyes small, separated above by more than diameter of eye. Pronotal and elytral coloration as in males although sometimes sutural bead and explanate margin completely black. Pronotal proportions as indicated in Figure 5. Pygidium entirely yellow or with fuscous basal spot. Ventral abdominal segment 6 with central, glossy yellow, reniform light organ and remainder of surface black, or with yellow (luminous tissue?) or pale apical margin. Female flash-response a single flash about 0.6 seconds in duration and emitted approximately 0.6 seconds after beginning of male flash. *Concisus* females have pronotal ratios exceeding 0.31 (versus ratios less than 0.31 in *pyralis* females; see below). They also have flat pronotal flanges (versus with submarginal ridges in *pyralis*).

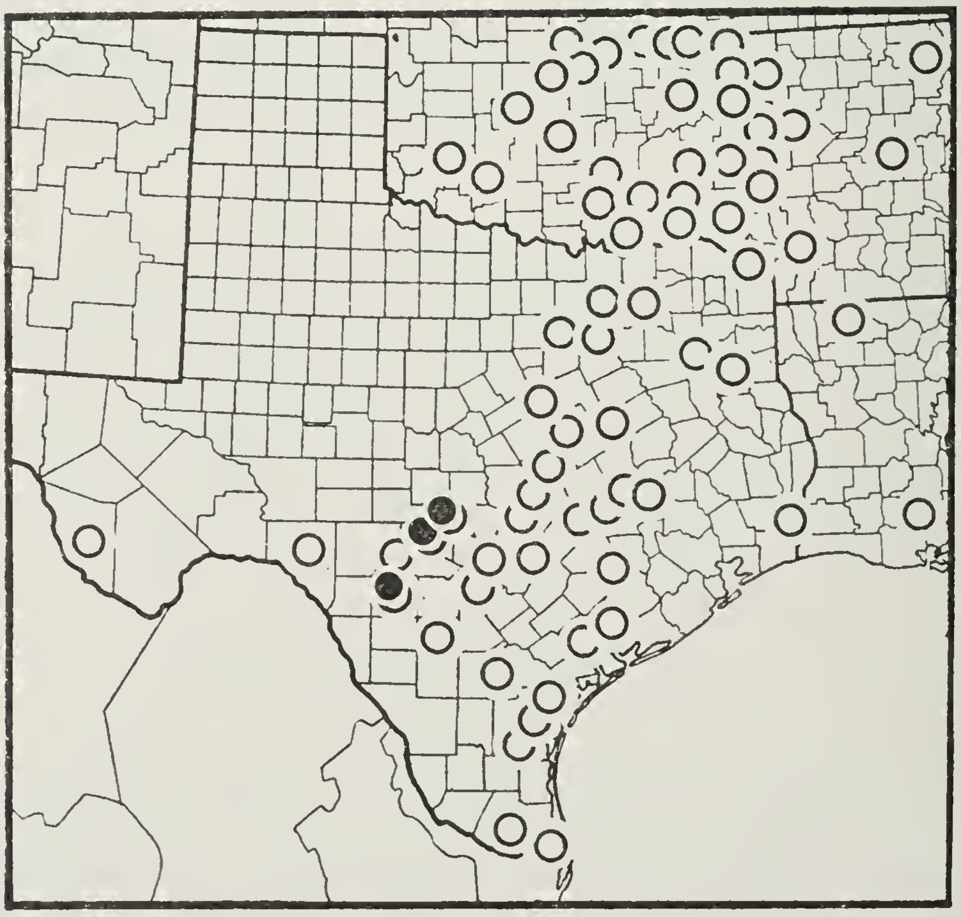


FIGURE 6. Distribution of *P. concisus* n. sp. in dots and that *P. pyralis* (L.) in circles. *Pyralis* occurs throughout the eastern U. S. (Lloyd, 1966a map).

Distribution: See Figure 6. Nearly 400 specimens from Kansas, Arkansas, Oklahoma, and Texas, previously identified as *pyralis,* were reviewed to determine the distribution of *concisus.* TEXAS (no locality). Belfrage, two males (MCZ)[3]. TEXAS. Uvalde Co., Garner St. Pk., 32 mi. N. Uvalde (Frio Riv.) ± 1800 ft., 15 Aug. 1955, T. J. Cohn, one female (UMMZ). TEXAS. Uvalde Co., V-20-38, J. H. Robinson, one male (CAS). TEXAS. Gillispie Co., VI-23-40, D. J. and S. N. Knull, two males, two females (OSU). Behavior vouchers collected at type locality (see above) Holotype, 44 males, 9 females.

Notes: This species is named for the short flash pattern interval and short female delay as compared with its close relative, *P. pyralis.*

P. pyralis behavior vouchers collected at the *concisus* type locality, 33 males, 14 females.

The morphological characters given to distinguish *concisus* from *pyralis* permit correct identification of all voucher specimens of both species.

Green (1956), in his revision of *Photinus,* noted variations in *pyralis* from Brownsville, Texas, and one specimen from Uvalde. I have seen these; the Uvalde specimen is *concisus* (see above, Coll. Robinson) and I will defer judgement on the identity of the Brownsville specimens until I have made field observations.

LeConte (1881) described *Photinus benignus.* In his collection (Museum of Comparative Zoology) are a male and female labeled *benignus;* Dallas, Texas, Boll. The male bears a red label: Type 2792. The female is numbered "2." LeConte did not designate a holotype nor has anyone since, a lectotype. I have labeled the male "Lectotype, *Photinus benignus* LeConte: Lloyd, J. 1966," and the female "Lectallotype *Photinus benignus* LeConte: Lloyd, J. 1966." Both of these specimens are *P. pyralis.* Green (1956) correctly synonymized *benignus.*

The following change in Green's key is made: Couplet 9, page 566, should read:

9. Ventral segments 6 and 7 transversely convex; segment 5 with pale apical border (except in *P. concisus* which occurs in central Texas only)............*P. pyralis* group.. 12
Ventral segments 6 and 7 nearly flat; segment 5 entirely dark piceous or black 10

The following addition to Green's key is made: Couplet 13, page 566:

13. Mandibles slender, etc..*P. australis* Green.
Mandibles stout. Head nearly flat between eyes, surface smooth, with simple punctulation. Ventral segments 2 to 4 entirely dark piceous. Size larger, form more elongate... 13A
13A. Antepenultimate tergite entirely black; ventral segment 5 entirely black..*P. concisus* Lloyd.
Antepenultimate tergite with translucent or white lateral borders; ventral segment 5 with pale apical margin.................*P. pyralis* (Linnaeus).

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[3] Belfrage was a mid-nineteenth century collector who collected extensively in the Waco-Clifton region of Texas, as well as near San Antonio and Austin. In 1870 he made a two month collecting trip into West Texas. A collection of insects from Waco which he sold to Dr. H. A. Hagen was later presented to the Museum of Comparative Zoology, Harvard College (Geiser, 1937).

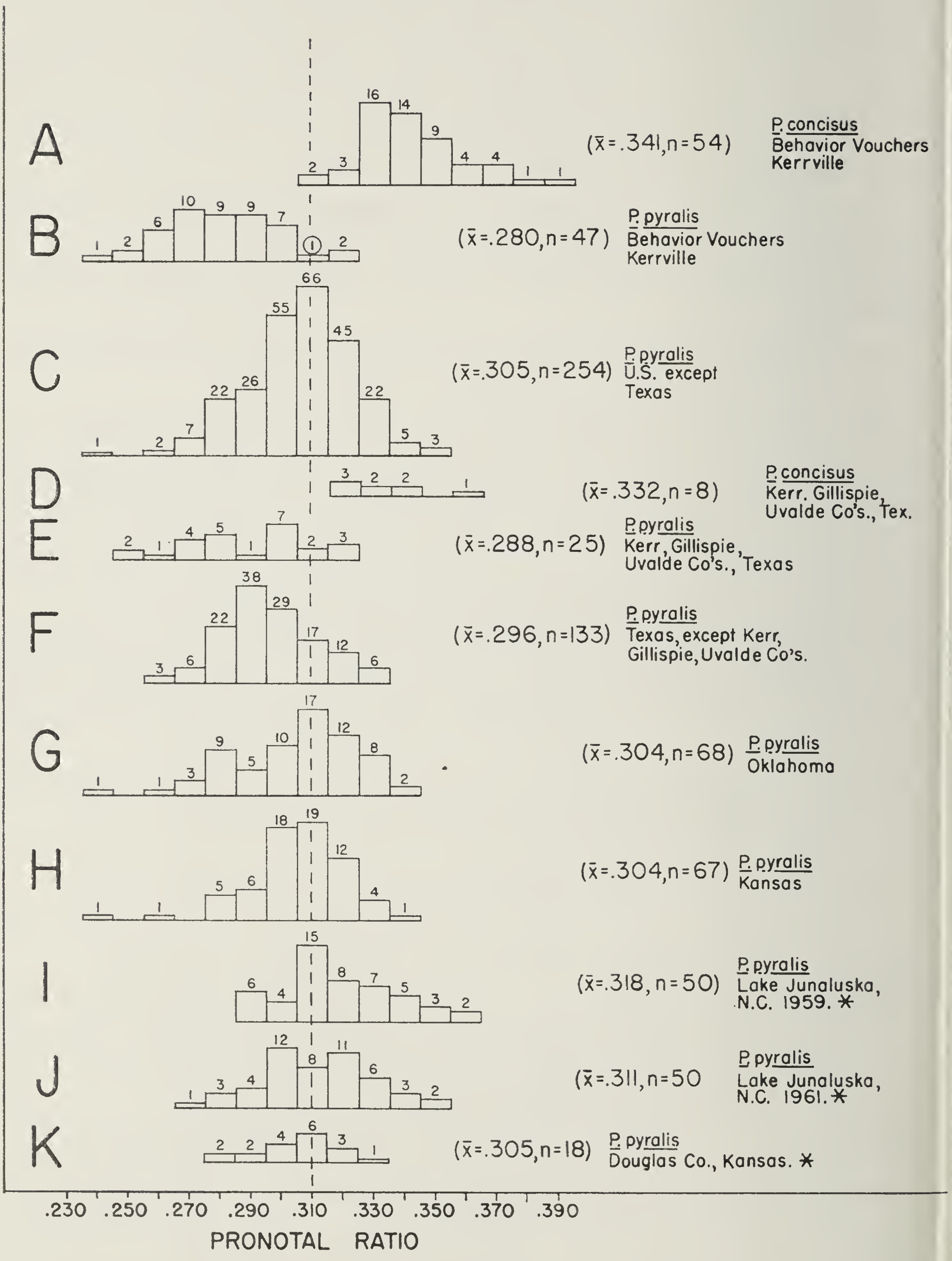

FIGURE 7. Pronotal ratios for *concisus* and *pyralis* from various localities as indicated. D includes the two Belfrage specimens of unknown origin. *L. Junaluska, North Carolina, 29 June, 1959 and 28 June, 1961, H. V. Weems: Douglas County, Kansas, June 28, 1919, W. E. Hoffman.

GEOGRAPHIC VARIATION OF PRONOTAL PROPORTIONS—CHARACTER DISPLACEMENT?

There is nearly complete separation of Kerrville *concisus* and *pyralis* when the width of the pronotal explanate margins (flanges) is plotted as a function of total pronotal width (Figures 5 and 7 A, B). A similar separation is found if marginal width is plotted as a function of body length. No separation occurs when the width of the pronotal central disk is plotted against body length.

Pronotal proportions for *pyralis* specimens from outside Kerr, Gillispie and Uvalde Counties (i.e. Texas, other counties, and Oklahoma, Kansas, Arkansas, Illinois, Ohio, etc.) are variable and fall within, as well as on both sides of, the hiatus that largely separates voucher *pyralis* and *concisus* (Figure 7 C). Two possible explanations for the separation of these values (i.e. the cut-off of high *pyralis* values) are: 1) Pronotal proportion values are grouped in inbred demes and the demes I sampled at Kerrville "happened" to be nearly mutually exclusive. The data do not suggest this; a) museum specimens of *concisus* and *pyralis* from Kerr, Gillispie, and Uvalde Counties also show this separation (Figure 7 D, E), and b) there is broad variation in pronotal ratios in series of museum specimens that apparently were taken from single demes elsewhere (Figure 7 I, J, K). 2) The pronotal ratio in *pyralis* is correlated (e.g., pleiotropy) with some aspect of the beetle's ecology and in the Edwards Plateau portion of its range ecological conditions limit certain variation that is tolerated in other localities. Figure 7 shows the distribution of *pyralis* ratios for various localities. The means are similar for "all U. S. except Texas" (Figure 7 C), for Kansas only (Figure 7 H), and for Oklahoma only (Figure 7 G). The mean for Texas specimens from counties *other than* Kerr, Gillispie, and Uvalde is lower (Figure 7 F), and the mean for Kerr, Gillispie and Uvalde *pyralis* is lowest (Figure 7 E).

One element in the environment of *pyralis* that is different in the Edwards Plateau portion of its range is the presence of *concisus* and this may be a case of character displacement (Brown and Wilson, 1956), but the width of the pronotal margins is certainly only indirectly involved (Mayr, 1963 (p. 311)).

Photinus dimissus LeConte

This species occurs in Texas and southern Oklahoma (see map, Lloyd, 1966a) and is found in meadows, pastures, and fields. Observations were made near Jarrell, Williamson County, Texas, 27-29 May, on a population that numbered hundreds of individuals.

Male flashing activity began between 17 and 26 minutes after sunset and ended except for a few stragglers by 2 hours after sunset. Males fly within two meters of the ground, usually just above the tips of vegetation in straight or meandering flight. The male flash pattern is a single flash about 0.2 seconds in duration at temperatures near 70°. Flash pattern interval is about one second in duration (67-68°, range 0.7-1.7, $\bar{x} = 1.0$, $n = 22$). Males fly 5-10 cm. during the flash and 20-100 cm. between flashes. Their light-trails are variable in form: straight, curved, or hooked, and with rises or dips.

Females were found on the ground. They responded to flashes of males and the flashlight with single-pulsed flashes at short delays. The flashes of one recorded female averaged 0.38 seconds in duration and were emitted at an average delay time of 0.17 seconds at 76° (Figures 1 and 2). This is the shortest delay yet recorded for any firefly (Lloyd, 1966a, b).

Male approaches to captive and free females were observed. Several exchanges of signals were usually required for a complete approach. Females didn't answer every male flash (although the morpheme is the single flash) and sometimes would fail to answer as many as six consecutive flashes. Male flash intervals during the approaches were more variable than those in advertising males.

On one occasion I noticed that two flashes of a male on the ground followed immediately those of a flying male. The flying male turned and approached, but then hesitated and eventually flew away after the flashes of the grounded male began to precede his own.

Acknowledgments

I wish to thank the following individuals and institutions for the loan of specimens: Dr. H. D. Blocker, Kansas State University, Dr. H. R. Burke, Texas A and M University, Dr. G. W. Byers, The University of Kansas (KU), Dr. P. J. Darlington, Jr., Harvard University (MCZ), Mr. J. W. Green, California Academy of Sciences (CAS), Dr. H. F. Howden, Canadian National Collection, Dr. L. L. Pechuman, Cornell University, Dr. C. A. Triplehorn, Ohio State University (OSU), Dr. R. L. Wenzel, Chicago Natural History Museum, Mr. R. E. Woodruff, The Florida State Collection of Arthropods, and the University of Michigan, Museum of Zoology (UMMZ).

I also thank Dr. T. H. Hubbell of the University of Michigan and Dr. T. J. Walker of the University of Florida for their helpful comments and criticisms on the manuscript. Mr. Paul Laessle of the Department of Zoology of the University of Florida kindly executed Figure 7.

This investigation was supported by NSF Grant 3366 (University of Michigan, Training and Research in Systematic and Evolutionary Biology), and the Sigma Xi—RESA research fund.

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Observations on the Biology of Gymnaetron pascuorum (Gyll.) (Coleoptera: Curculionidae)[1]

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Gymnaetron pascuorum (Gyllenhall) is a European species believed to have been introduced into eastern United States sometime prior to 1952 (Sleeper, 1954). At that time it was collected from strawberry, potato, and alfalfa plants. Warner (1964) gave the first Oregon record as 1960 when adults were found on the bark of Colorado blue spruce, *Picea pungens,* stated that the species had been reported from eastern United States as breeding in buckhorn plantain, *Plantago lanceolata* L., and added that adults had been collected from the tunnels of the dogwood borer, *Thamnospecia scitula,* and found in association with mantid eggs, *Tenodera* sp. Adults were reared from the spikes of buckhorn plantain in western Oregon during July, 1963, and identified by R. E. Warner, U. S. National Museum.

There are several European references listing *P. lanceolata* as the host plant, but only brief comments were found relating to the biology of the weevil. Bargagli (1885) stated the larvae are in the seeds of *P. lanceolata* and that the insect completed its development in the month of August. Hoffman (1958) stated that the larvae do not form galls, and that eggs are laid in May to July and that the adults emerge in August and September.

The general features of the biology of *G. pascuorum* were investigated in western Oregon because most aspects of the life history were unknown. The host plant, *P. lanceolata,* is probably a plant native to Europe that has spread rapidly during the past 50 years in the northwestern United States and is a known causative agent of hay fever (Gilkey, 1957). It is a competitive weed in pastures and cultivated crops and a restricted noxious weed in vegetable and field crop seeds (Warren, 1957).

Methods

Field-collected buckhorn plantain was held for insect rearing studies under laboratory conditions by confining either individual plant material spikes or detached florets in cotton-stoppered shell vials or in petri dishes. Individual spikes of insectary-grown plants were caged, and permitted to continue growth in plastic petri dishes modified as follows: One lip of the top and bottom of the dish was cut to accommodate a cotton-wrapped plantain scape and thus form an "insect proof" seal for the spike. Four ¼ inch holes were drilled in both the top and bottom of the petri dish for ventilation, and the holes closed with a fine-mesh screening. The cages were held in position on plant stakes by elastic bands. This procedure permitted the admission of mated pairs of weevils at the appropriate stage of plant development. Population trends of adults were estimated by sweeping weedy areas with an insect net.

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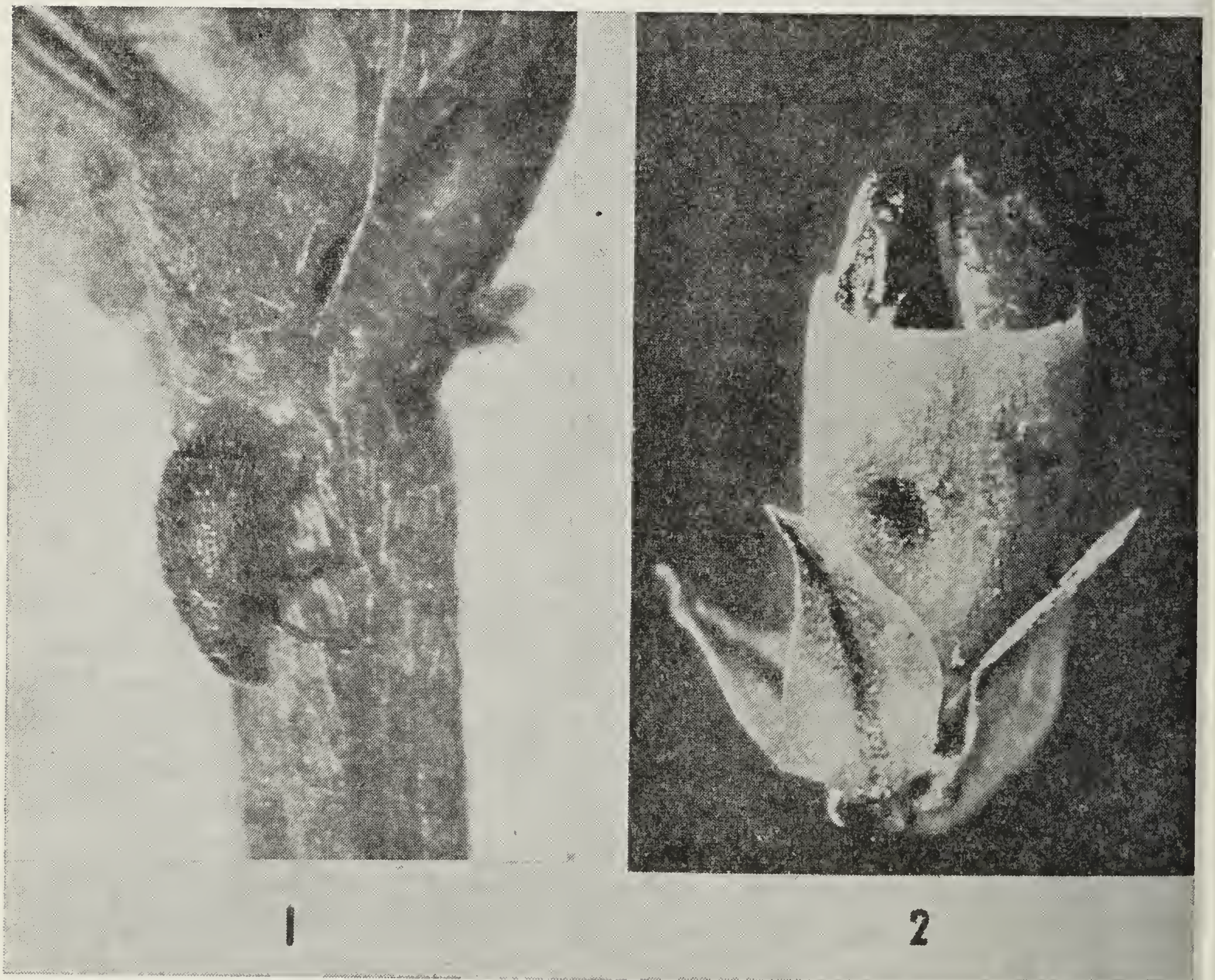
[1] Technical paper no. 2291, Oregon Agricultural Experiment Station, Corvallis.

Results and Discussion

Adults left their overwintering sites and appeared on buckhorn plantain at the time the earliest spikes developed and the basal florets bloomed. This varied from the 3rd to 4th week in May in western Oregon. The adults fed in the portion of the scape 1 to 5 mm. below the base of the spike (Fig. 1). They clasped the angulated scape along the ribbed area and inserted their beak deeply into the furrowed area and remained outwardly immobile. Possibly this feeding was essential to sexual maturity as mating pairs were then observed for approximately six weeks, or until late June.

Examination of field-collected plant materials indicated that oviposition takes place during June and into mid-July. Apparently there was an extended oviposition period because during mid-July eggs, larvae, pupae, and teneral adults were dissected from spikes. Because of the difficulty involved in observing weevil activity in the compact spike, oviposition was not observed. Adults commonly wedged themselves between the florets, with the head directed inward, and were never observed to assume an attitude on the spike that suggested oviposition.



Figures 1-2, 1—*Gymnaetron pascuorum* feeding on scrape of plantain (adult length, 1.8-2.0 mm). 2—Capsule of *Plantago lanceolata* showing oviposition site (center of capsule), initially infested and darkened seed (upper left), and subsequent larval injured, but normal colored, seed (upper right).

Possibly the oviposition cavity was formed with the beak because there was a small entry hole (approximately 0.1 mm. in diameter) in the side of the circumscissile capsule (Fig. 2), and a definite chamber or cell (approximately 0.2 mm. in diameter by 0.3–0.35 mm. long) in the developing seed. The elongate egg was free in the chamber, except the posterior end was firmly attached to the wall of the entry hole.

There was a plant reaction to the insect's activities. The tissue surrounding the entry hole on the capsule darkened in color (Fig. 2), and the developing seed darkened in contrast to the light brown color of the paired seed (Fig. 2). This response was more striking early in the oviposition period than later, and may be a reflection of plant maturity. Since oviposition was not observed, dissection of plantain seeds for observations on the duration of the egg stage were necessarily based on ova of unknown age classes. Thus, the duration in days from collection to dissection (which resulted in desiccation of the egg and terminated the observation) ranged from 3 to 11 days for hatching.

The newly hatched larvae were completely protected within the developing seed. They fed initially by extending the egg gallery and, as they developed, they consumed the greater part of the initially attacked seed. Then, they penetrated the septum separating the paired seeds and fed to a varying extent on the paired seed and often the wall of the capsule. The previously mentioned plant reaction or darkening of tissue color was not as evident from larval feeding as it was from oviposition injury. Occasionally, the second seed attacked darkened slightly adjacent to the feeding injury, but most often it remained a much lighter brown in color than the earlier attacked seed (Fig. 2, upper right seed). Injured seeds were not viable, although uninjured seeds had only 64 percent germination when incubated 3 weeks.

The duration of the various larval stages was not determined because any attempt to dissect the early larvae from the seeds resulted in death of the individuals exposed. Last instar larvae, which had consumed enough of the seed to be exposed, pupated in the laboratory. Teneral adults emerged within 5 to 8 days and became fully colored in an additional 48 hours. Depending on the season, newly emerged adults were collected in the field from the first or second week in July until the third week in August. The adults gradually disappeared from the field during late August and early September, although buckhorn plantain spikes were still available in all stages of development. There was a seemingly long period of time in which all stages of insect development were present in the field. It was concluded that there was not a second generation but more probably a sequence of brood development correlated with the phenological sequence of the host.

The sweep-net sampling gave only approximate trends in weevil populations. Based on 10 sweeps per sampling site, and from 3 to 10 sampling sites per field trip, the following general trends were evident: 1) No weevils were recovered prior to late May. 2) First recoveries averaged around 1 weevil per 10 sweeps, and during early June (peak recoveries for the season) they averaged a little over 10 per 10 sweeps. 3) Counts dropped rapidly during June, and by early July averaged around 1 per 10 sweeps. 4) From mid-July to mid-August (new brood emergence) most counts were around 0.5 per 10 sweeps. 5) From the 2nd to 3rd week in August counts rose from slightly over 1 to around 3 per 10 sweeps, and then gradually declined and no weevils were recovered by sweeping after the first week in September.

In an attempt to determine the duration of the life cycle, plantain was grown in an insectary and spikes of the plant were isolated in 12 petri dish cages. One pair of mating weevils was admitted to each cage. Under these conditions, the time from mating (pre-oviposition) to emergence of adults ranged from 40 to 58 days. No mating was observed among the newly emerged adults, which suggested there was no attempt to initiate a second generation; however, being confined on a matured plantain spike rather than a developing spike may have precluded mating and oviposition stimuli.

The maximum yield was 33 weevils per cage, and the minimum was one weevil per cage (average 14.2), excepting the 3 cages in which adults died prior to oviposition. This is a tentative estimate of fecundity because of the numerous biological limitations placed on the insects confined with a single plantain spike.

Parasitism was determined by placing flowers with oviposition scars in individual vials for laboratory rearing. The most common species reared was *Xenocrepis* sp. (Pteromalidae), determined by B. D. Burks, U. S. National Museum. Unfortunately it is not a species that appears in the U. S. N. M. collection; so it is not known if it is an indigenous species or one introduced with the weevil. No reference to parasitism of *G. pascuorum* was found in the literature. A few specimens of *Eupelmella vesicularis* (Retz.) (Eupelmidae) were reared and these were determined by Dr. Burks who commented that this species has a wide host range and is usually a hyper-parasite. The latter species has been reported from various hosts in Oregon and the Pacific Northwest (Peck, 1963).

Xenocrepis adults began emergence around the 3rd week in July and continued to emerge through the first week in August. As a rule, the parasites emerged from 1 to 3 days prior to weevil emergence from plant materials of comparable collecting dates. Considering all of the laboratory rearing trials conducted during three seasons, the extent of parasitism was negligible; however, considering only plantain spikes that produced parasitized weevils, the range of parasitism was from 28 to 100 per cent. Only an occasional (possibly hyperparasite) individual of *E. vesicularis* was reared.

Overwintering weevils were recovered from modified Berlese-type funnel-processed samples of grass crowns, moss, and soil litter from roadsides, abandoned fields, and wooded areas. Only one live adult was recovered from several hundred winter-collected samples of plantain spikes, and none was recovered from the crown, roots, or old plantain debris during winter months. Adequate protection may be the primary requirement for overwintering, and might explain the unusual habitats for this weevil reported by Warner (1964).

The population density of *G. pascuorum* present in western Oregon during the 1963 to 1965 seasons had very little effect on plantain seed production. The spikes produced in late summer and early fall escaped the oviposition period. Spikes produced early in the season were either not infested or yielded only 1 to 3 adults, which, assuming two seeds were injured by each larva, and an average of 72 mature seeds per spike, would represent a 3 to 9 percent seed reduction in infested spikes. The impact this weevil could exert on plantain stands is further diluted by adaptations of the plant. The seed remains viable when buried in soil for several years, and it is a perennial plant that can reproduce by crown expansion (Gilkey, 1957, Warren, 1957).

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Current Literature

Helgesen, R. G. and Post, R. L., 1967. *Saprophagous Scarabaeidae of North Dakota.* North Dakota Insects—Pub. No. 7. Dept. of Entom., Ag. Ex. Sta., North Dakota State Univ., Fargo, N. D., 60 pp., 45 figs.

In this monograph the taxonomy and ecology of 50 species in 5 sub-families and 14 genera are described for North Dakota. Data extending the range of many species are given.

Luis E. Peña, Secretary, Sociedad Chilena de Entomologia, announces the forecoming appearance of No. 6, *Revista Chilena de Entomologia,* March 1968. Total length, 250 pp., consisting of several collected papers.

A new journal, Oriental Insects, has been founded to enable entomologists engaged in the study of the insect fauna of south and southeastern Asia to publish their results in one place. The scope of the journal is broad, covering many areas of insect study. It is anticipated to be a quarterly of about 100 pages. Rates to individuals $7.00 per year, to institutions, $10.00. Write Dr. V. K. Gupta, Dept. of Zoology, Univ. of Delhi, Delhi-7, India.—N.M.D.

Notes on the Name Leptopiinae[1] (Coleoptera: Curculionidae)

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The name of the broad-nosed weevil group whose type-genus was for so long known as *Leptops* has been the subject of considerable confusion, and it is believed that a summary of pertinent facts will be of assistance.

In such standard modern works as *Coleopterorum Catalogus* and Blackwelder's checklist of the Latin American Coleoptera, *Leptops* and Leptopinae are used. *Leptops* Schoenherr, 1834, however, is a homonym of *Leptops* Rafinesque, 1820 (Pices). Sir Guy Marshall noted this fact, and in 1952 he proposed the substitute name *Leptosus* and used the spelling Leptosinae for the subfamily name. Unfortunately, Marshall wrote his 1952 paper without knowledge that Oke had published the replacement name *Leptopius* a few months earlier in his 1951 report on "The Coleoptera of the Russell Grimwade Expedition" (*Mem. Nat. Mus. Victoria* 17:24). The Oke reference does not appear in the *Zoological Record* volume for 1951, but it is recorded in the 1952 volume. Oke's statements concerning the problem are as follows: "Subfamily LEPTOPIINAE/ A slight emendation, necessary by the change of the typical genus./ *Leptopius* nom. nov./ This name is proposed for the well known *Leptops,* which had been used by Rafinesque (1820) for *Pices* before being used by Schoenherr [1834]. Both Lea [*Ann. Soc. Ent. Belgique* 50:239-314, 1906] and McKeown [*Proc. Linn. Soc. N. S. Wales* 64:408, 1939] have suggested that *Leptops* and *Baryopadus* are the same, but this is not so. *Baryopadus* has very different tarsi, as already mentioned by Marshall [*Ann. Mag. Nat. Hist.* (X)6:558-559, 1930]." These details are so similar to those given by Marshall in 1952 [*Ann. Mag. Nat. Hist.* (XII)5:264-265] that I suspect that it was from data supplied by Marshall from the Commonwealth Institute of Entomology and British Museum (Nat. Hist.) that Oke prepared his report.

Thus we have the following:

Leptopius Oke

Leptops Schoenherr, 1834, *Genera et Species Curculionidum . . .* 2:297. Type-species by original designation: *Curculio robustus* Olivier, 1807; Australia. Homonym of *Leptops* Rafinesque, 1820, Pices.

Leptopius Oke, 1951, *Mem. Nat. Mus. Victoria* 17:24, replacement name for *Leptops* Schoenherr.

Leptosus Marshall, 1952, *Ann. Mag. Nat. Hist.* (XII)5:265, an unnecessary replacement name for *Leptops* Schoenherr.

Article 39 of the *International Code of Zoological Nomenclature,* on the homonymy of the type-genus, states: "The name of a taxon of the family-group is invalid if the name of its nominal type-genus is a junior homonym." Hence, we have:

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[1] This is number 13 of a series of reports resulting from research done under National Science Foundation Grant G-18933.

LEPTOPIINAE (Lacordaire) Oke

Leptopsides: Lacordaire, 1863, *Genera des Coléoptères* 6:232, 246.
Leptopsinae: Pascoe, 1870, *Journ. Linn. Soc.* 10 (Zool.) (47):436.
Leptopodinae: Pascoe, 1872, *Ann. Mag. Nat. Hist.* (IV)9:132.
Leptopinae: Pascoe, 1885, *Ann. Mus. Civ. Genova* (II)2:218, 326.
Leptopsini: Faust, 1885, *Deutsche Ent. Zeitschrift* 29(1):167. Misprinted Leptosinae in *Coleopterorum Catalogus,* 1931.
Leptosini: as an error in spelling, Schenkling and Marshall, 1931, *Coleopterorum Catalogus* 114 (Leptopinae): 1.
Leptosinae: as an error in spelling, Schenkling and Marshall, same reference.
Leptopiinae: Oke, 1951, *Mem. Nat. Mus. Victoria* 17:24.
Leptosinae: Marshall, 1952, *Ann. Mag. Nat. Hist.* (XII)5:264.

Part of the confusion concerning *Leptopius* arose from the fact that in 1906 (*Ann. Soc. Ent. Belgique* 50:318-319), Lea misidentified a species of *Leptopius* as *Baryopadus corrugatus* Pascoe, the type-species of *Baryopadus,* 1870, and he then erroneously concluded that *Baryopadus* was the same as *Leptopius.* Without having adequate knowledge of the problem, K. C. McKeown, in 1939, in a paper entitled "A Note on the Synonymy of Leptops" (*Proc. Linn. Soc. N. S. Wales* 64.408), stated that Lea had "proved conclusively" that *Leptops* and *Baryopadus* are the same. For reasons unknown, McKeown placed *Leptops,* 1834, as a synonym of *Baryopadus,* 1870. He also erroneously "sank" Leptopinae as a synonym of Entiminae and the Leptopini as a synonym of Stenocorynini. McKeown overlooked the fact that in 1930 [*Ann. Mag. Nat. Hist.* (X)6:558-559] Sir Guy Marshall had revealed Lea's errors and demonstrated that *Baryopadus* and *Leptopius* are different genera. In 1952 [*Ann. Mag. Nat. Hist.* (XII)5:264-265] Marshall gave more details concerning the two genera and a key to separate them from an allied new genus, *Amnemus* Marshall.

Corrections

A correction: In the Key to the genera of American bidessine water beetles, *Coleopt. Bull.,* 21 (1), I was in error in recording the parameres of the male genitalia of *Hypodessus* as unjointed. It is *Hydrodessus, Brachyvatus,* and *Amarodytes* in which the parameres are unjointed. The joint in the paramere of *Hypodessus* is illustrated by Spangler, P. J., in The Catherwood Foundation Peruvian-Amazon Expedition. XIII—Aquatic Coleoptera. . . . *Mono. Acad. Nat. Sci. Philadelphia, No.* 14, pl. 1, figs. 2 and 6.

Also, the last item in the references cited is by Zimmermann, A. Südamerikanischen is the correct spelling of the mispelled word in the title.—FRANK N. YOUNG

There were a number of omissions on the cover of the December issue (Vol. 21). Most serious is the complete deletion of the first entry under the NOTES: *"Collecting in Mexico,* by Ball and Whitehead, p. 122." In addition, McDermott should have been listed as author of the *Photuris* article, and Edmonds as the author of the *Phanaeus* paper.—J. N. L. STIBICK

An unfortunate typographical error occurs on page 95 of volume 21. Line 3 from the top should read: 'It should be noted that this work would not have been possible *without* Green's (1956) revision.' Biologists owe a great debt to sound taxonomy, and the work reported in this review emphasized the value of Green's work.—R. H. ARNETT, JR.

A Genus of Malachiidae New to the United States

W. Wittmer
Herrliberg-Zürich

Through the courtesy of R. Constantin, Paris, I received a small lot of *Malachiidae* which Mr. Mahoux collected in the United States in 1964. The material contained a genus new to the fauna of the United States. The genus in question is *Ebaeus* Er., the major distribution of which lies in the Mediterranean and Central Asia. I was able to report a first species of *Ebaeus* from Mexico in 1966 (Ent. Arb. Mus. Frey 17:31 fig. 5) which is allied to the species described here.

This genus fits as follows into the table of Arnett, 1963, "The Beetles of the United States" and readers should replace 49(47) by:

49(47)	Apex of elytra simple or slightly impressed	50
	Apex of elytra appendiculate	EBAEUS
50(49)	Antennae flabellate	ATTALUS subgenus ACLETUS
	Antennae not flabellate	ATTALUS

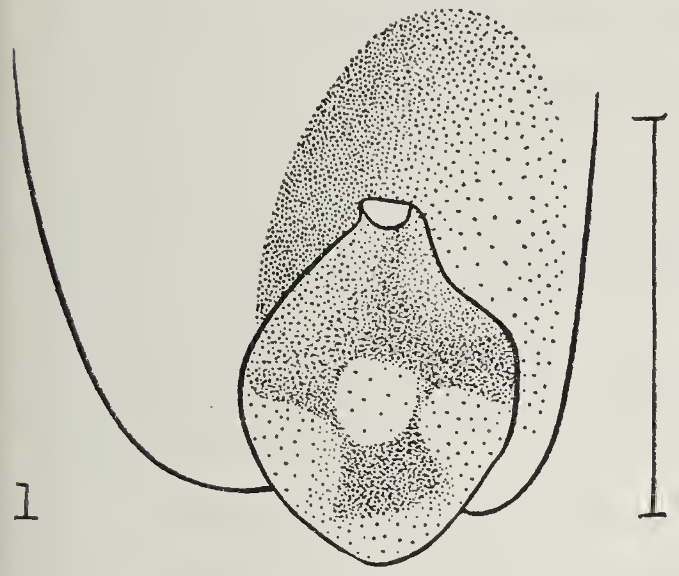
Ebaeus viridescens Wittmer, NEW SPECIES

Male head, scutellum, and abdomen black, antennae brownish, 1st joint and 2nd to 4th more or less testaceous underneath, prothorax and legs uniformly orange, elytra dark green metallic with a faint blueish gloss, a small patch at the apex, and posterior appendage yellow-orange, anterior appendages darkened towards the tip.

Head with the eyes somewhat smaller than the prothorax, frons between the eyes almost flat, smooth, sparsely and finely pubescent. Antennae not extending much over the shoulders, joints 3 to 8 broadened inwardly towards the tip, joint 3 having a pointed tip, 4 to 8 a rounded tip, 9 less broadened towards the tip, 10 almost parallel, 11 oblong; joint 2 somewhat shorter than 3, 3 to 10 of about equal length inter se, 11 about as long as 2 and 3 combined. Prothorax broader than long, sides strongly rounded, basal angles more strongly rounded than the anterior angles, disc slightly convex, surface almost smooth, partly almost imperceptibly microsculptured (x64). Elytra slightly broadened towards the apex, without distinct puncturing, almost dull, suture slightly thickened and raised near the apex, sides with a bump near the appendage, posterior appendage almost oval (fig. 1), narrowed towards the tip, which is covered by the tip of the narrow anterior appendage; surface of the posterior appendage almost flat, only on each side of the base and almost in the middle with a very small raised field. Last tergite almost as long as broad at the base, sides narrowed towards the apex, apex almost completely rounded with the sides.

Female of the same coloring as the male, except the elytra which are completely greenish-blue and without the yellowish patch. Apex of elytra simple, without an appendage, last tergite (fig. 2) broader than long, sides strongly narrowed towards apex, apex with an almost triangular incision.

Length: 2-2.2 mm.



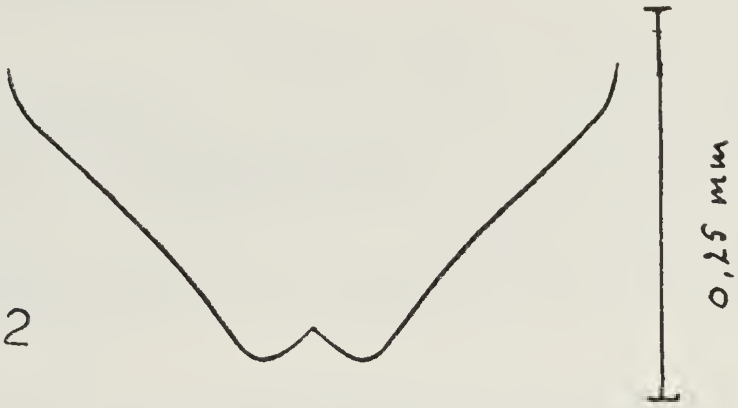


Figure 1. Apex of left elytra of *Ebaeus viridescens* n. sp. male
Figure 2. Last tergite of *Ebaeus viridescens* n. sp. male

Locality: Boulder, Colorado, 21 June and 11 July, 1964 on *Pinus ponderosa.* Holo-, Allo- and 1 Paratype in my collection.

It should be noted that both species recorded so far from North America have blueish-green or greenish-blue elytra, a color which is found rarely in this genus. The new species differs from *E. mexicanus* Wittm. by the elytra which are less elongate towards the apex, the testaceous appendage of a different shape, and the different coloring of the elytra.

FIELD NOTES

NOTES ON ADDITIONAL DISTRIBUTION AND ECOLOGY OF EUXESTUS PUNCTATUS LEC. (COLEOPTERA: COLYDIIDAE) A single specimen of *Euxestus punctatus* was taken while sifting at Wheatley Provincial Park near Wheatley, Ontario, Canada, on 2 Sept. 1966. Sifting was done in a variety of forest situations and there was no clue as to the beetles ecology. Dr. W. J. Brown of the Canadian National Collection kindly confirmed the identification. He also stated that the species was previously unrecorded from Canada. (personal communication).

Blatchley 1910 records *Euxestus punctatus* as common in the southern ⅔ of Indiana and notes that it is gregarious in winter and early spring beneath bark, especially of elm and willow.[1]

On 7 July 1967, four specimens of *E. punctatus* were found at Wheatley Park, in the galleries of carpenter ants (*Camponotus herculeanus pennsylvanicus DeG.*) inside an oaken log. On 22 July 1967, two more specimens were taken near Tilbury, Ont., again in galleries of the same ant under bark of a dead elm. On 26 July 1967, 3 additional specimens were uncovered at Wheatley Park in a carpenter ant nest in an old beech log. In each case the beetles were found crawling about the gallery walls undisturbed by the excited ants. Apparently it is a tolerated guest. The oval, strongly convex body shape of *E. punctatus* does not permit this beetle to move freely under bark or enter small galleries of xylophagous insects as most other members of the family do. Thus the specious galleries of carpenter ants seems to be an excellent niche for this unique Colydiid, which is locally common and well established in eastern Essex County, Ontario.—K. Stephens, Tucson, Ariz.

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[1] The editor has taken this species in northern Indiana and as far north as St. Lawrence Co., N. Y.

The Internal Sac of the Aedeagus of Podabrus (Coleoptera: Cantharidae)

Kenneth M. Fender[1]
Linfield Research Institute, McMinnville, Ore.
and
Laura Jean McCarley
Sherwood, Oregon

Intricate and fascinating are the shapes of the evaginated internal sac of the aedeagus in many species of some genera in the CANTHARIDAE. Similar interesting features of the internal sac have been found to occur in some genera in other families of beetles. These features indicate that potentially important differentiating characteristics are here to be found. Despite the fact that these characteristics have been so recognized in the past, too little effort has been made to utilize this organ in the description of or recognition of species. This is due largely to the problems of affecting the eversion of the internal sac.

A growing awareness by the senior author that the internal sac did offer valuable taxonomic characters made it requisite that further study of this organ be made.

History

The internal sac of the aedeagus has only recently been used as a factor in the separation of closely similar species in the Cantharidae. The senior author is at present attempting a reanalysis of the specific characteristics in the hitherto neglected organ. Prior to this time, the internal sac had been known to have possible taxonomic value but the use thereof had seldom been employed.

Sharp and Muir in 1912 noted and illustrated the complicated internal sacs of the aedeagae of *Silis ruficollis* and *Cantharis (Rhagonycha) limbatus.* Their study does not stress nor survey the importance of this organ in the family but merely notes it as being quite complex in the species cited.

McKey-Fender (1950) used the more or less deflated median lobe of the aedeagus and described briefly the internal sac ". . . membranous internal sac, which is armed apically with a flagellum composed of a bundle of long slender bristles," in her new subgenus *Cultellunguis* of the genus *Cantharis.*

Werner (1966) used the internal sac in studies of the Anthicidae. However his sketches indicate that they may have been made with the organ not everted.

Green (1966) commented briefly on the extreme importance of the everted internal sac of the aedeagus in the Cantharidae. He noted the difficulty in obtaining a fully everted condition, especially from dry cabinet specimens. Therefore, he confined his studies to the more strongly chitinized and "positively distinctive" aedeagal features. In this difficult genus (Silis), Green reveals some species complexes that he is unable to resolve. Whether or not the eversion of the internal

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[1] This study was supported by National Science Foundation Grants: GB-4097 & GB-6283X

sac would have solved these problems is not known. Studies of the future may determine this.

The senior author is at present involved in a revisional study of the genus *Podabrus.* In this study attempts are being made to utilize the everted internal sac of the male aedeagus towards a better understanding of this difficult genus. The junior author is occupied with the preparation of specimens for the work and experimentation with methods in search of the most satisfactory procedures for such preparation. If successful, attempts to utilize these methods with other poorly known genera of the Cantharidae will be made.

THE AEDEAGUS OF PODABRUS

(Figs. 1, 2)

The male genital armature (aedeagus) is comprised of two major divisions: An enveloping protective tube, the *tegmen,* and the membranous inner tubular *median lobe.*

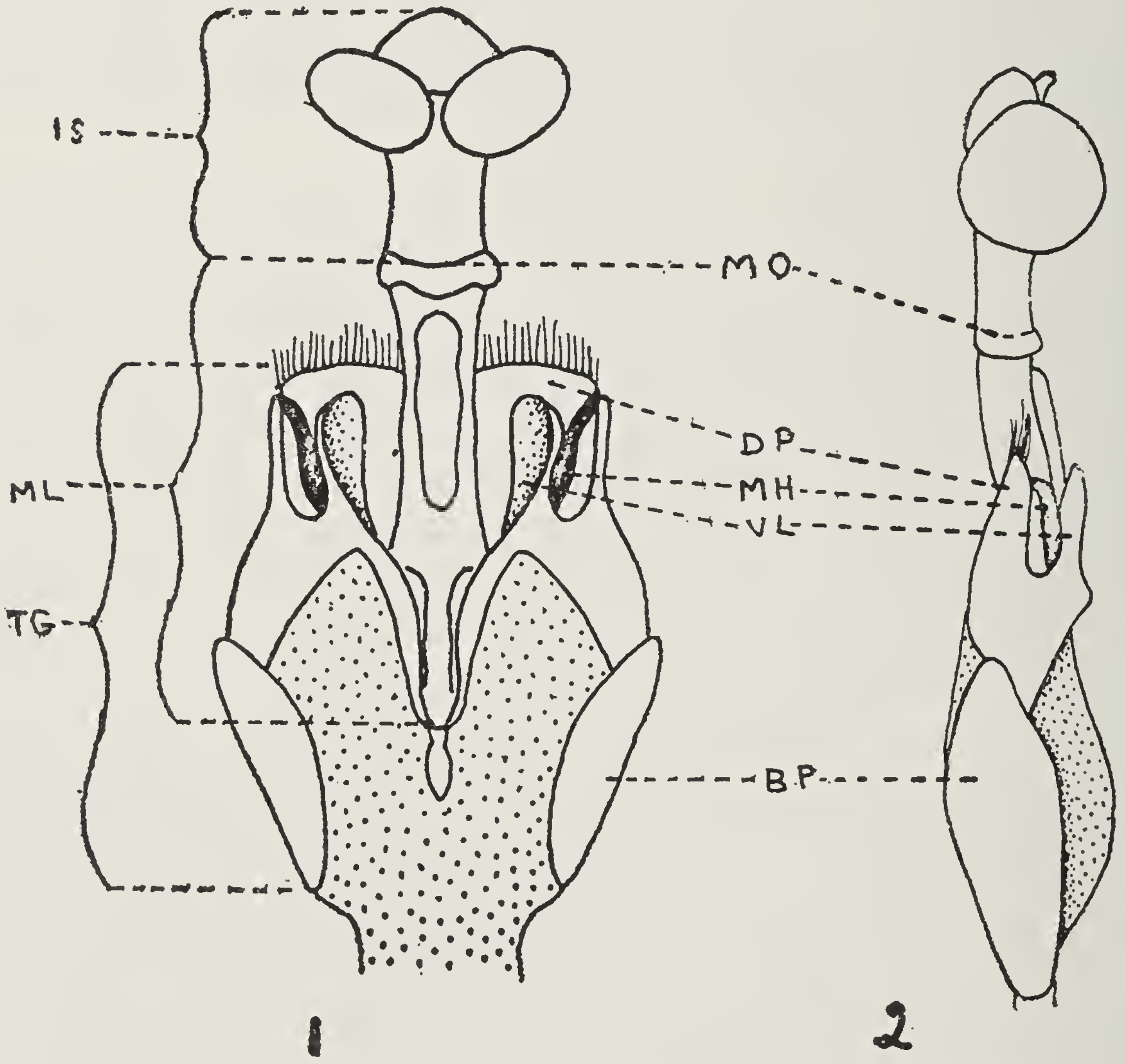
The tegmen possesses a pair of moderately strongly sclerotized *basal plates,* a *dorsal plate* that is membranous with the apical margin more or less widely sclerotized, and a pair of sclerotized *ventral lobes.*

The *basal plates* are circular to subovate, investing only the proximolateral portions of the tegmen. They offer no obvious distinguishing characteristics.

The *dorsal plate* may have the apical margin rounded, truncated or more or less widely deeply emarginate. It may or may not have an apical fringe of long hairs. If not having an apical fringe, the inner surface may or may not be clothed with moderately sparse erect hairs. These characters of the dorsal plate may be and often are diagnostic. The *ventral lobes* are the more or less strongly produced lobes of the latero-ventral sclerites. These sclerites rise from beneath the distal edge of the basal plates. They are produced inwardly on the ventral face until they meet for a short distance, usually with a short suture or trace thereof at the juncture. Ventrally these plates diverge apically, forming a deep, more or less V-shaped incision. Laterally these plates extend to connect with the ends of the sclerotized apex of the dorsal lobe. Laterally there is a deep, more or less U-shaped incision on each side. The ventral lobes thus formed may be in the shape of rather broad plates apically or more or less compressed and contorted lobes. They may or may not attain the distal margin of the dorsal plate or they may extend beyond it. The ventral lobes similarly offer good diagnostic characters in some species.

Inside the tegmen is the *median lobe.* In many species it contains, on its dorsal face, a heavily sclerotized laterally produced pair of parameres, the *median hooks,* united at their bases. The apical portions of the median hooks are bent up and more or less produced distally, becoming visible in the lateral apical incisure of the tegmen. In some species the median hooks are rudimentary, evidenced only by sclerotized patches on the median lobe. The median hooks frequently offer good characteristics.

Invaginated in the distal end of the median lobe, through a *median orifice,* is the *internal sac.* This, the intromittent portion of the aedeagus, becomes everted and fully extended in copulation. In the Cantharidae it best displays itself when in this state of eversion and extension. Otherwise it is of little value as an aid to the recognition of or differentiation of species. The extended internal sac is generally comprised of a shaft that may be long and slender, to short and broad, and a head that may be small to massive. Both the head and the shaft may be moderately simple but usually one or both are complexly ornamented with diverticula of varying sizes, shapes and numbers, variously located on the organ. On either the head or shaft or on their diverticula may be found setigerous areas in which the density and length or stoutness of the setae may vary from area to area. Inside the everted internal sac are a pair of longitudinal struts. These may be quite evident or scarcely, if at all, discernible. As viewed laterally, they may be median or on the ventral or dorsal surface. As viewed ventrally, they may be paired and separated, paired but connate medially or fused into a broad plate. It is the internal sac that should in future studies be found to possess the best diagnostic characteristics.



Figures 1 & 2. Aedeagus of *Podabrus punctatus* LeC. (internal sac evaginated). Fig. 1, ventral view. Fig. 2, lateral view. Legend: BP-basal plate, DP-dorsal plate, IS-internal sac, MH-median hooks, ML-median lobe, MO-median orifice, TG-tegmen, VL-ventral lobe.

Methods and Materials

As the present studies are pretty much pioneer in nature, many problems have been encountered that have perforce been faced with a rather hit or miss approach. The senior author began the work anticipating that some colleague had faced similar problems and could offer some clues or formulae that would simplify his tasks. Unfortunately no one was found who could offer such assistance; therefore a trial and error approach was initiated with frequent unsatisfactory results. A number of problems became immediately evident: 1. The most satisfactory method of removal of the aedeagae from the specimens, both freshly collected and dried cabinet; 2. The best procedure for the eversion of the internal sac in as nearly a normal condition as possible; and 3. The best method of preservation and storage of the prepared aedeagae with the everted internal sac intact.

Green (1966) recommends the relaxation of the males of *Silis* for three days in a very damp relaxing chamber. Following relaxation the removal of the aedeagus is accomplished by cutting the apical abdominal sternites medially throughout their length. The aedeagus is then removed, glued to a triangle and pinned beneath the specimen.

Sharp and Muir (1912) had success in dissection by placing the aedeagus in a weak caustic potash for a time and thus swelling the muscles. Through the insertion of a very fine syringe into the median foramen and the gentle application of localized pressure, they managed to evaginate the internal sac in a manner approximating the normal state.

Their process was tried by the senior author but without too much success. More attempts, using other more or less similar forms of preparation, were made but were equally unsuccessful. Despite these failures, continued experimentation is being done with this method.

The occasional good example with a well evaginated internal sac was hardened and placed on a slide in Canada Balsam as a means of preservation. This proved to be unsatisfactory. The organ immediately collapsed, possibly due to the weight of the cover glass or the consistency of the Balsam. The authors prefer the most rapid and satisfactory methods available for the preparation of their specimens. Toward this end, considerable experimentation was done and after over a year of disappointments, a surprisingly simple process was evolved that is by far the most satisfactory found to date.

In this method the beetle is relaxed in a small container. We have found aluminum ¼ to ⅓ cup measures satisfactory for this. The measure is nearly filled with cold water, the beetle placed in the water which is then brought to a vigorous boil and the specimen permitted to be agitated in the boiling water from two to twelve minutes, usually depending on the size of the beetle. By the time the water has started to boil, the specimen is so relaxed that there is no danger of breakage.

The beetle is next removed from the water and placed on a blotter to remove any excess water. It is then placed on its back, under the microscope and still on the blotter, with the tip of the abdomen towards the operator. The aedeagus is removed by pressing down with an insect pin or dissecting needle medially of the abdomen. The pressure is carefully advanced towards the abdominal apex with a rolling movement, forcing the aedeagus to near the apex or even pushing it entirely out. Extreme care must be employed in this procedure that the pressure be applied to the base of the aedeagus and not the ventral surface, thus avoiding possible distortion of the aedeagus. When maximum extension has been attained by this means, an insect pin can be inserted under the apical edge of the 7th sternite near the lateral margin, thence carefully worked in behind the aedeagus and used as a lever to force it out.

Quite frequently the boiling and agitation of the beetle, also produces eversion of the internal sac of the aedeagus. In the event of complete eversion it is desirable to return this organ to the water before it has an opportunity to dry and shrink. It will there remain terete and extended until it can be preserved in a vial of alcohol. Preserved, the vial and beetle should each be given the same accession number, or some form of identification so that if they become separated, they can readily be reunited.

The authors are using an accession system as indicated above, the vials, upright in racks, are kept apart from the beetles. An accession number is applied to each vial. The beetles are kept in Schmidt type insect boxes, each beetle with its accession number on a label on the insect pin beneath the locality and collectors labels. This system is used to avoid the continuous setting and releasing of the aedeagae from points upon which they will be affixed following the completion of the study.

Once the internal sac has been everted, it can be allowed to dry. Tests have been made on specimens of several species to ascertain whether or not the everted internal sac can successfully stand repeated drying and boiling. In all instances, the drying and shriveling of a fully everted sac seems not to damage it at all or very little. One specimen was boiled and dried and boiled again 15 times and was just as well produced following the fifteenth boiling as it was following the first. Others have been carried through four or five such repeated operations without any seeming damage. This repetition is not recommended as it is quite possible that too vigorous reboiling might burst or damage an otherwise excellent specimen.

Comments and Explanations

Although the value of the aedeagus as an aid to the identification of species has long been recognized and used, stress has been towards the more readily accessible and more strongly chitinized tegmen of the organ. The membranous internal sac that usually must be everted and inflated to be studied is something else. Many consider that this procedure is too complicated and difficult for general use and that many collectors, especially amateurs would quit, rather than go to such extremes to attempt to determine their species.

This is quite true and it is not the intent of the authors to propose such use. Such advanced procedures as the use of the evaginated internal sac would be confined to the studies of the specialist or revisor. In reality, the senior author is hopefully using this means to help him understand this genus and its species; to help him assess the exterior characteristics that have in the past been utilized to separate the genus into groups; to help him determine what exterior characters (if any) are valid for the differentiation and recognition of species; and to comprehend its relationship with its most closely allied genera.

To illustrate some of the problems that occur in the recognition or identification of closely allied species, the following examples are offered.

In some instances, the coloration may vary considerably, other conditions being similar (i.e., sculpture, shape, size, etc.). Even the tegmen of the aedeagus may be so similar that differences are not discernible. In these instances the internal sac can be a valuable aid to the determination of the possible existence of more than one species.

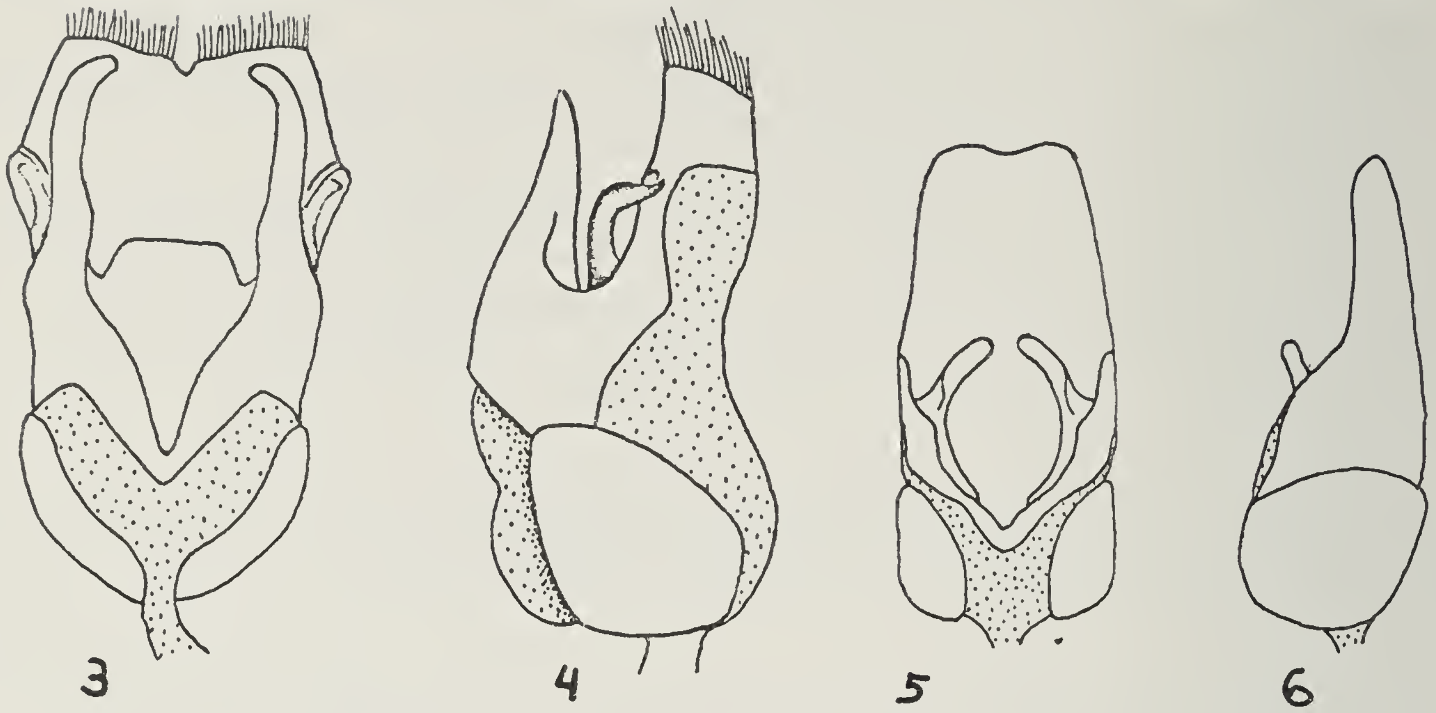
As demonstrated by Green (1947), *Podabrus knobeli* Lec. and *P. frosti* Fend. vary externally to the extent that they are inseparable but they can readily be distinguished by differences in the tegmena. Conversely *P. comes* Lec., *P. pruinosus* Lec. and *P. gradatus* Lec., all are readily separated on the basis of color, but have been united all as subspecies of *P. pruinosus*, this being the only character for separation. The tegmena of these show no discernible differences.

P. knobeli Lec. and *P. frater* Lec. are differentiated on the basis of color and the presence on *P. frater* or a more or less evident brush of hair on the mesotibiae (vestiture normal on *P. knobeli*). In these two species, the tegmena are indiscriminate. However the internal sacs validate these two species.

There are one or two species of *Podabrus* wherein attempts to obtain eversion have been unsuccessful despite adequate series for such eversion. The reason for this failure has at present not been determined. It may be that the degree of difficulty of eversion, or impossibility thereof, is a specific characteristic; that these species have reduced median orifices, the edges of the median orifices are less elastic or that the internal sacs are less pliant.

The system described above is not necessarily recommended for all families of the Coleoptera. It has proven decidedly workable with most species of the genera *Cantharis* and *Podabrus* of the CANTHARIDAE. Unsuccessful attempts have been made to obtain eversion of the internal sac by this process in the genera *Ellychnia* and *Pterotus* of the LAMPYRIDAE, *Chauliognathus* of the CANTHARIDAE, and *Cyphon* of the HELODIDAE. The median orifice in *Cantharis* and *Podabrus* is comparatively large and the margins might well be rather elastic thus permitting the more ready eversion of the internal sac. The simplicity of the system does suggest that attempts to apply it to other groups of beetles towards a better understanding of such groups are advisable. The senior author feels that there may well be more than one very similar species represented in some groups, species that to now have been merged under one name, and that a study of the internal sac will determine this whether pro or con.

Studies of the tegmen of the aedeagus have proved that keys to *Podabrus* of Fall and Fender, based as they are on male ungual characters (i.e., claws broadly cleft, narrowly cleft, toothed at base or some combination of these) whereas generally successful, are artificial and lead to unrealistic groupings of the species. These findings have been confirmed by the conformations of the internal sac. Fall's primary key point had seven divisions based on these ungual characters. Fender



FIGURES 3 and 4. Aedeagus of *Podabrus sp.* nr. *dreisbachi* Green with median hooks exposed. Fig. 3, ventral view, Fig. 4, lateral view. FIGURES 5 & 6, Aedeagus of *Podabrus lateralis* LeC. (?) with median hooks reduced and concealed. Fig. 5, ventral view. Fig. 6, lateral view.

recognized eight groups, similarly based. In Fender's group I, all claws of both sexes are broadly cleft; all species having the median hooks of the median lobe exposed (figs. 3, 4). In groups III to VIII, the males have at least the protarsal claws narrowly cleft and some of the remaining claws toothed; all species having the median hooks of the median lobe reduced and concealed (figs. 5, 6). In group II, the males have all claws with a short basal tooth. The larger species of group II have genitalia similar to those of group I, whereas the smaller species have genitalia like those of groups III to VIII. This indicates that at least Fender's group II should in some way be further divided to accommodate this separation. Whether or not this would be sufficient has not as yet been determined.

Even should the method presented here be proven to be unsuccessful in some groups, it is felt that students of such groups might find it advantageous to seek some other method (possibly a modification of this) for study of the internal sac and that in many instances they might be able to resolve such species complexes as may be found to occur in these groups. The writers feel that their continued experiments and investigation may reveal some process that will permit the simple eversion of the internal sac in these groups where they have heretofore failed.

Enthusiastic reactions received from colleagues point to the desirability of the continuation of the work. The suggestion has been made that the studies be expanded to include other families. This will have to be a project of the future. Hopefully, the use of the characteristics of the everted internal sac may lead to the resolution of the species complexes that now perplex so many students of the Coleoptera.

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FIELD NOTES

MEREDITH, SOUTH CAROLINA. In the October 1967 issue of the University of Kansas Science Bulletin (vol. XLVII, pp. 145-313), Dr. H. L. Willis published a paper on the bionomics and zoogeography of tiger beetles of saline habitats in the central United States. In the discussion of *Cicindela togata* Laferté which occurs on South Carolina coastal saline flats he stated, "The town of Meredith, South Carolina could not be located."

Meredith, a locality name I used from 1925 to 1929 for many hundreds of herpetological and entomological specimens, was a station on a railroad no longer in existence. The locality was in Lee County, 12 miles from Bishopville and 15 miles from Sumter, near Manville on present day roadmaps, at the junction highways US 15 and South Carolina 441.

How this locality could have been used for *C. togata* is a mystery and is certainly an error. The nearest saline flats are ninety miles away. Habitats found at Meredith may be known from the tiger beetles collected there: *Megacephala (Tetracha) virginica* L., *M. carolina* L., *Cicindela repanda* Dej., *sexguttata* Fab., *punctulata* Oliv., *abdominalis* Fab., *trifasciata ascendens* LeC., *gratiosa* Guerin, and *scutellaris rugifrons* Dej.—O. L. CARTWRIGHT, U. S. National Museum

ATAENIUS FRANKENBERGERI Balthasar, a species mistakenly placed in synonymy with *At. sulcatulus* (Chevrolat) by Dr. E. A. Chapin in his Revision of the West Indian Beetles of Scarabaeid Subfamily Aphodiinae (Proc. USNM, vol. 89, 1940, p. 41), has been collected at Brazos, Texas; Gulfport, Mississippi; Dade Co., New Smyrna, and Key Largo, Florida. The Key Largo specimens were collected by L. J. Bottimer and R. E. Woodruff in dung in the nest of *Neotoma floridanus smalli* Sherman. The specimens have been compared with Dr. Balthasar's type.

Ataenius waltherhorni Balthasar is represented by a specimen labeled Everglade, Florida, May 1912 in Wm. T. Davis collection, Purdue University. This species is not a synonym of *At. darlingtoni* Hinton (synonym of *Ataenius picinus* Harold!) as suggested by Dr. Chapin in the same paper. The type of *waltherhorni* has also been examined.

Ataenius frankenbergeri and *At. waltherhorni* were described by Dr. Vladimir Balthasar in Zweiter Beitrag zur Kenntnis der neotropischen Scarabaeiden, Arbeit. Morph. und Taxon. Ent. Berlin-Dahlem, Band 5, Nr. 1, pp. 55-51, 1938.—O. L. CARTWRIGHT, U. S. Nat. Museum.

Notes on Buprestidae (Coleoptera): Part VI

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Kansas City College of Osteopathy and Surgery
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This paper includes new synonymy in the genera *Chrysobothris* and *Agrilus*, and a description of the female *Chrysobothris beameri* Knull. New distributional and biological data for other Buprestidae are included.

Acmaeodera fisheri vermiculata Knull. 1947. Ohio Jour. Sci. 47:174. An interesting record of this species was made by D. S. Verity in California, Mono County, White Mountains, Cow Camp at 10,000 feet elevation on *Cercocarpus ledifolius* Nutt. killed by 2-4D. This form is usually found in the low desert regions of southern California.

Acmaeodera palmarum Timberlake. 1939. Pan-Pac. Ent. 15:181. Two of this species were taken in Mexico, Baja California, 19 mi. S. of Bahia San Luis Gonzaga, 5 June 1966 by D. S. Verity on *Eriogonum inflatum* Torr. & Frem. This is the first record of this species from Baja California.

Cinyra robusta Chamberlin. 1920. Ent. News 31:241. A fine series of this species was collected near Del Rio, Texas on *Diospyros texana* Scheele. A comparison of specimens with the type of *robusta* and a cotype of *prosternalis* Schffr. in the California Academy of Sciences indicates these are *robusta* and not *prosternalis*. Chamberlin (1920) indicated the differences between the species. Vogt (1949) and Knull (1950) record *prosternalis* from *Diospyros texana*. It is possible that some of these records might be *robusta*.

Chrysobothris beameri Knull. 1954. Ohio Jour. Sci. 54 (1): 27, 28, figs. 6, 9-12. This species was described from a unique male in the University of Kansas collection. A female, which has been compared with the type, is made known here. *Description of female*—Differs from male as follows: Head less densely pubescent; last visible abdominal sternite narrowly emarginate (fig. 1); prosternum less densely pubescent; anterior tibia without apical dilation, middle tibia straight.

Length 12 mm.; width 4.9 mm.

Plesiallotype, female (writer's collection) from Texas, Chisos Mountains Basin, 21 June 1965, on *Pinus cembroides* Zucc., G. H. Nelson.

Chrysobothris rossi Van Dyke. 1942. Proc. Calif. Acad. Sci. 24(3):117, pl. 7, fig. 4.

Chrysobothris prosopidis Fisher. 1942. U. S. Dept. Agric. Misc. Publ. No. 470:70, figs. 22, 113, F. (NEW SYNONYMY).

An examination of the type of *C. rossi*, including the male genitalia, and comparison with a long series of *C. prosopidis*, including topotypes, show that *rossi* is conspecific with *prosopidis*. Since publication of the description of *rossi* Van Dyke, March, 1942, preceded that of *prosopidis* Fisher, September, 1942, the former name should be used for this species.

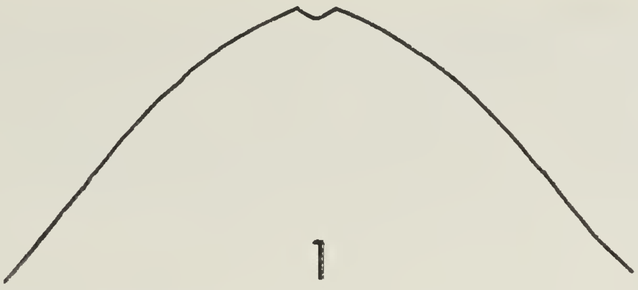

Figure 1. *Chrysobothris beameri* Knull, last visible abdominal sternite, female.

Agrilus inhabilis Kerremans. 1900. Ann. Soc. Ent. Belgique, 44:341.

Agrilus ineptus Horn. 1894. Proc. Calif. Acad. Sci., ser. 2, 4:378-379 (name preoccupied).

Agrilus chalcogaster Van Dyke. 1946. Pan-Pac. Ent., 22:83-84. (NEW SYNONYMY).

As a basis for his description of *chalcogaster* Van Dyke had a unique "female." He related it to *Agrilus inhabilis* Kerr. (*A. ineptus* Horn). An examination of the genitalia of the type of *chalcogaster* reveals it is in reality a male. A comparison of the true female of *chalcogaster* with the lectotype of *A. ineptus* Horn in the California Academy of Sciences (referred to by Van Dyke, 1946) shows they are the same species and *chalcogaster* should be considered a synonym of *inhabilis* Kerr.

Since this species is uncommon in collections, it might be worthwhile to mention the following records. From Mexico, Baja California: one male, Sierra Laguna, 16 miles N.E. of Todos Santos, 19 August 1955; two females, 1 mile W. of Catavina, 3 September 1955, all by J. P. Figg-Hoblyn. From California: one female, Riverside County, Shavers Summit, 5 October 1951 by T. H. Lauret; one male, Inyo County, 9 miles E. of Big Pine, 10 August 1965 by A. Hardy; two males, Joshua Tree National Monument, Long Canyon, Cholla Branch, 23 May 1963 by E. L. Sleeper; one male, one female, Santa Rosa Mountains, Highway 74, 2000 feet, 12 June 1965 on *Baccharis sergiloides* Bray; four males, same place and on the same plant, 10 June 1965 by G. H. Nelson.

Acknowledgments

Thanks are extended to Mr. Hugh B. Leech of the California Academy of Sciences and Dr. George Byers of the University of Kansas for permitting the writer to examine types in their care and for the loan of specimens, and to Mr. David S. Verity for allowing the writer to mention new records from his collection.

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FIELD NOTES

THE POSSIBILITY OF DISCOVERING NEW SPECIES IN THE GENUS OBEREA (COLEOPTERA: CERAMBYCIDAE) This note is intended as a supplement to my paper in The Coleopterists' Bulletin (1962, 16:5-12) where I record the host for sixteen of the twenty-one species of *Oberea* listed. It seems unquestionable that several species can be properly determined only by field study since museum specimens proved to be inadequate. I wish therefore to direct attention to the valuable information contained in the paper, "Notes on Cerambycidae," Ent. News, 36:139-142, 1925 by Champlain, Kirk, and Knull. This paper was not included in my literature citations as it had no specific taxonomic content. However, it is important to note that they found *Oberea* larvae (which to date can not be satisfactorily identified) working in twenty-seven different hosts near Harrisburg, Pennsylvania. For at least eleven of the host genera I know of no authentic records which would associate them with a known species of *Oberea.* In four cases, they list more than one species of the genus which is attacked by the larvae. Their locality appears to be an ideal focal point from which anyone could make field studies of the majority of Eastern North American species.—Stanton D. Hicks, Entomology Research Institute, Research Branch, Canada Department of Agriculture, Ottawa, Ontario.

BRACHYPTEROLUS PULICARIUS L. (Nitidulidae) was shown by Parson, 1943, in Rev. of Nearctic Nitidulidae. Bull. of Mus. of Comp. Zool., Harvard college, vol. XCII, No. 3 to have only a Palearctic distribution prior to 1918. In the above monograph he noted that the beetle then ranged from Nova Scotia to Wisconsin. While collecting in the Selkirk Mts., Boundary Co., Idaho, elevation 6000 feet, a specimen was taken on flowers. Hatch does not include this species in Part III of his Beetles of the Pacific Northwest (1962).—N. M. D.

OBSERVATION ON PELECOTOMA FLAVIPES MELSHEIMER. (COLEOPTERA: RHIPIPHORIDAE) Rivney (1929 Revision of the Rhipiphoridae of North and South America. *Memoirs of the American Ent. Soc. #6*) reports that the biology of *Pelecotoma flavipes* is still unknown. However he believes it to be similar to that of the European *Pelecotoma fennica* (Paykull) which lives as a parasite on *Ptilinus* and *Trypoxylon* larvae. *P. flavipes* is considered rare and the author has taken it only by sweeping.

On 27 June 1967 I observed a female *P. flavipes,* near Wheatley Ontario, on the trunk of a dead elm devoid of bark. This trunk was riddled with holes caused by old and new attack of *Ptilinus ruficornis* Say. The beetle was running up and down on the sunny side of the trunk, pausing, and inspecting several of these holes. After a few minutes I captured it for fear it might enter the wood and escape.[1]

Even though this brief observation is not conclusive, it seems to lend much weight to the theory of its biology advanced by Rivnay.

To aid future observers it might be pointed out, that in the field *P. flavipes* is easily mistaken for one of many small, black *Mordellids* often found about dead wood. Its movements are strikingly similar. However *P. flavipes* is more parallel bodied and lacks a stylus on the abdomen. The flabellate (male) or pectinate (female) are hard to see in the field.—K. Stephens, Tucson, Ariz.

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[1] On several occasions the editor has taken as many as 10 specimens of this species on the bark of erect, dead beech trees. In Tippecanoe Co., Indiana they have been taken on dead oak.

A Brood of Callidium texanum Schaeffer (Cerambycidae)

Charles E. White, Indianapolis, Ind.

While searching for material with which to establish Indiana records of *Callidium,* the author and N. M. Downie of Purdue University toured the eastern portions of Tippecanoe County. No signs of beetle activity were encountered, however, where the native cedars (*Juniperus virginiana* L.) were numerous. Returning across wide-open prairie-like farmland, our attention was attracted by the dead foliage of a severed branch beneath a small solitary tree next to the fence which separated the road from the seemingly endless cornfields. Insect work was suggested by abundant pinholes, presumably for the ejection of frass, and confirmed by the galleries in the cambium layer.

This branch, which was about one and a half inches in diameter was brought indoors the same day, January 21, 1967, and stored in a closed container in an environment approximating 75°F. A cut into the wood disclosed a Cerambycid larva in a pupal chamber. This chamber was reclosed and the larva observed daily. It pupated on February 14th and was preserved for James S. Cope of San José State College, California.

On the following day the first adult of *Callidium texanum* Schaeffer emerged from the branch. Over the next four weeks it was followed by the astonishingly successful brood tabulated below:

Feb. 15	M	
16	M M	
17	M M M	
18	M	
19	M M	
20	M	
21	X X X X	
22	M M	
23	M M	p
24		
25	M M M M M M M	p
26	M M M	p
27	M M M M M M M M M M M M M	F
28	M	p p
1	M	
2	X X X X X X X X X X	F
3	X X X X X X X X	F F p p p p p
4	M M M M M M M	F F F F F F F F F F F
5	M	F F F F F F p p
6	M M	F F F p p
7		F
8		F F
9	M M	F p p p
10	M	F F p p
11		F F F F p
12	M	F F F F p
13 Mar.	M	F

M — male F — female X — sex not checked p — hymenopterous parasite

Even without the "X" individuals which were given away before they were checked to determine the sex, the remaining specimens present an obvious sexual pattern. Males emerged throughout the four week period with the greatest number appearing at mid-season. The females, during the last two weeks, appeared suddenly in quantity five days after the peak emergence of the males. Knowledge of the sex of the "X" specimens probably would not materially change the picture because those on the 21st are probably males, while at least half of those on the 2nd and 3rd are likely to be females.

In summary, the total of individuals emerging from the single branch was 137—composed of 115 mature beetles, 21 parasites, and a pupa.

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Chemsak, J. A. 1962. Observations on the habits of larvae and adults of *Callidium texanum* Schaeffer (Coleoptera: Cerambycidae) Journal of the Kansas Entomological Society, Volume 35, No. 3 Pages 321-323.

Linsley, E. G. 1964. The Cerambycidae of North America, Part V., Univ. of Calif. Publ. in Entomology, Volume 22 Pages 39-40.

FIELD NOTES

MICROMALTHUS DEBILIS LeConte (Micromalthidae) is generally described as a very rare beetle, although they are often found in large numbers. Larvae of this species are quite common in moist, red, rotten oak which has reached the stage of decay that allows it to be ripped apart with the hands. Adults may be reared by the hundreds from infested material.—Richard E. White, U. S. Dept. of Agriculture, Washington.

ACSIC files contain a rare publication added to the collection by Kenneth E. Weisman of Land O'Lakes, Wisconsin. The complete title page reads: "Bulletin of the Scientific Association of Peoria, Illinois. Published by the Association, 1887. Edward Hine and Co., Printers, Peoria." The publication is actually mimeographed and the copy is in good condition. The article itself is entitled: "Catalogue of Coleoptera collected in the vicinity of Peoria" by Emil Brendel, M.D. The publication is 8½ x 11 inches, with 21 pages of names listed without further data. Weisman writes that: "As far as I am able to determine Dr. Brendel collected and practiced medicine for about thirty years in Peoria, Illinois. He was considered a very capable M.D. as well as a Coleopterist. After his death the collection was given to Bradley University around 1890. At that time Bradley did not, I believe, have a Biology Department. Consequently the large collection was stored in the basement of the Administration Building and forgotten. In fact, the storage boxes were only rediscovered around 1945. Needless to point out the dermestids had long before finished their work—not a single specimen that I am aware of remains."

The list certainly is of historical interest, and copies may be obtained from ACSIC. If any additional information is known about this publication or the collection, we would like it for our files.—R. H. Arnett, Jr.

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TENEBRIONIDAE: Studying the cave-dwelling forms of the Western Hemisphere, T. J. Spilman, U. S. Nat. Museum, Washington, D. C. 20560.

CHRYSOMELIDAE: Revising Alticinae of Oceania; wish to borrow material from Fiji Is., New Caledonia, New Hebrides, New Zealand, etc. G. A. Samuelson, Department of Entomology, Purdue University, Lafayette, Indiana 47907.

SCARABAEIDAE: Revision of *Polyphylla* Harris in America, North of Mexico, by R. M. Young, Dept. Entomology, Purdue University, Lafayette, Ind. 47907. The *diffracta* complex in press, rest of the genus now being considered. Any specimens from Canada or the southeastern states will be appreciated.

OEDEMERIDAE: Preserved in alcohol (preferred) or pinned desired for revision of family for World. R. H. Arnett, Jr., Department of Entomology, Purdue Univ., Lafayette, Ind. 47907.

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THE COLEOPTERISTS' BULLETIN

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THE COLEOPTERISTS' BULLETIN
VOLUME 22 JUNE 1968 NO. 2

A Synopsis of the Genus Talanus Jacquelin du Val in America North of Mexico, with descriptions of two new species.

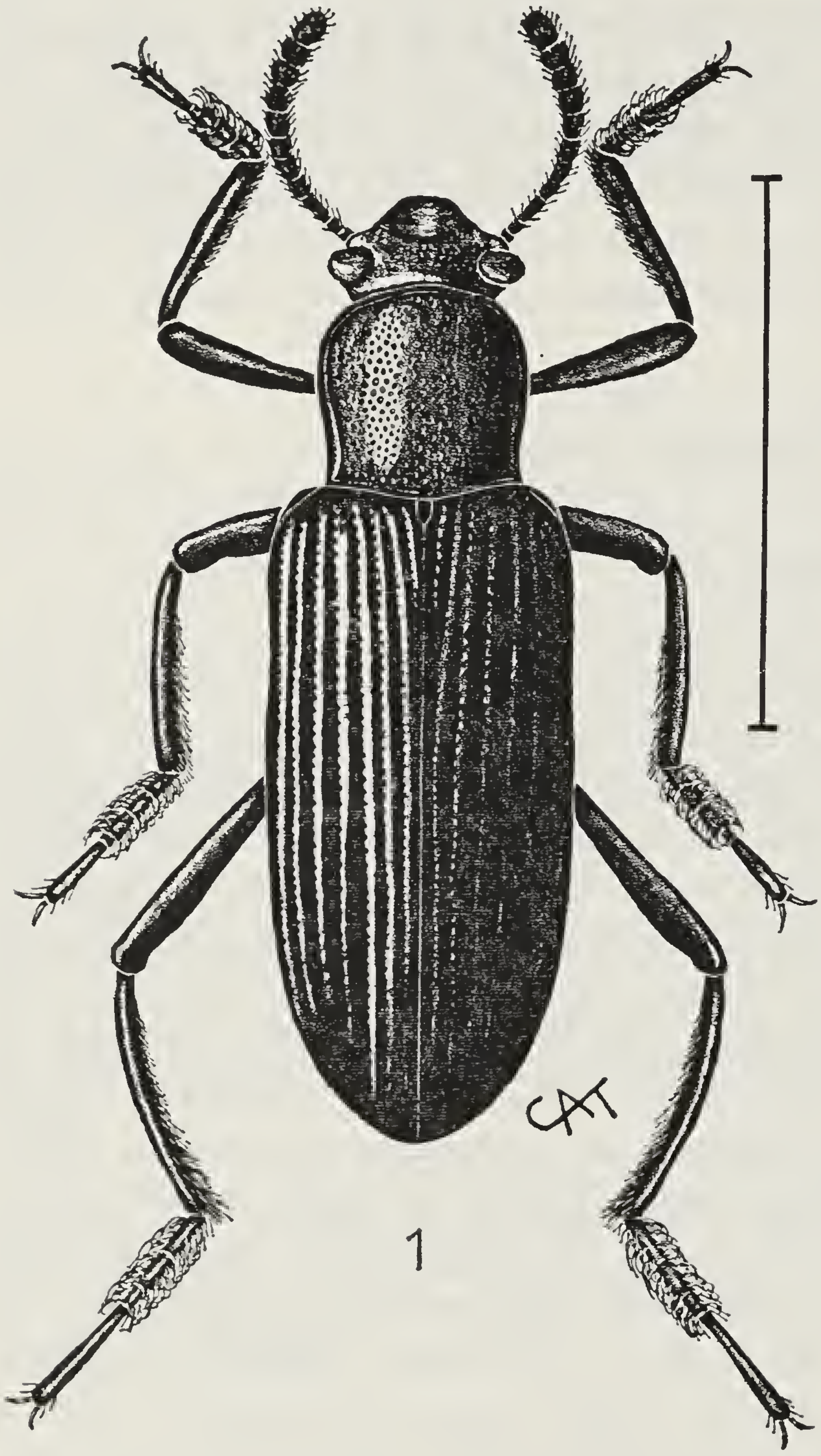
Charles A. Triplehorn
Department of Zoology and Entomology
The Ohio State University, Columbus

The genus *Talanus* is restricted to the Western Hemisphere and contains some thirty named species (Blackwelder, 1945, p. 543). Practically all of these are tropical, ranging from Mexico to Brazil, with a few known from islands of the West Indies. LeConte (1878, p. 421) described two species from Florida and, until now, these have been the only known North American representatives of the genus. The following two new species were discovered during the course of this investigation.

Talanus mecoscelis NEW SPECIES

(Figure 1)

Description—Holotype, male. Elongate, slender, black, shining. Head strongly constricted behind eyes with a pronounced transverse depression across vertex, a shallow frontal depression delimiting clypeus; surface coarsely and densely punctured on frons and vertex, more finely so on clypeus; eyes large, convex, weakly emarginate in front; antennae moderate in length, basal six segments slender, third the longest, seventh slightly wider, 8 to 10 still wider and subequal in size, eleventh larger, elongate-oval; terminal segment of maxillary palpus large, scalene. Pronotum one-eighth longer than broad, strongly and evenly convex from side to side, a strong marginal bead set off by a deep groove around entire perimeter, lateral marginal bead narrowly but strongly reflexed, sides strongly rounded in dorsal view, broadly sinuate in basal one-fourth; apex strongly rounded, angles obtuse and broadly rounded; base arcuate, angles acute and prominent; surface coarsely and densely punctured with a feeble median depression near base; ventral surface of pronotum coarsely and densely punctured, prosternum minutely rugulose, prosternal process strongly convex between coxae, the apex abruptly deflexed behind. Elytra coarsely punctate-striate, punctures in deep sulci, intervals strongly convex, impunctate; epipleural fold inflexed to beginning of terminal abdominal sternum, not attaining apex of elytra. Ventral surface of mesothorax, metathorax and abdomen finely and sparsely punctured; terminal two abdominal sterna expanded laterally, concealing large portion of epipleural fold. Legs very long, metafemora extending caudad beyond fourth (last) ventral abdominal suture, pro- and mesotibiae with conspicuous tooth on mesal margin of distal half, nearly hidden by dense patches of fine yellow setae; metatibiae with two very small, widely-spaced denticles on mesal margin nearly hidden by yellow hairs; tarsi extremely long, four-fifths as long as tibia on meso- and metathoracic legs; three-fourths as long as tibia on prothoracic legs; all tarsal segments except apical and penultimate with dense pads of long yellowish hairs; apical segments more cylindrical and as long as or longer than their respective basal segments combined, with only a few widely scattered hairs beneath; penultimate segments of each tarsus small, cylindrical.



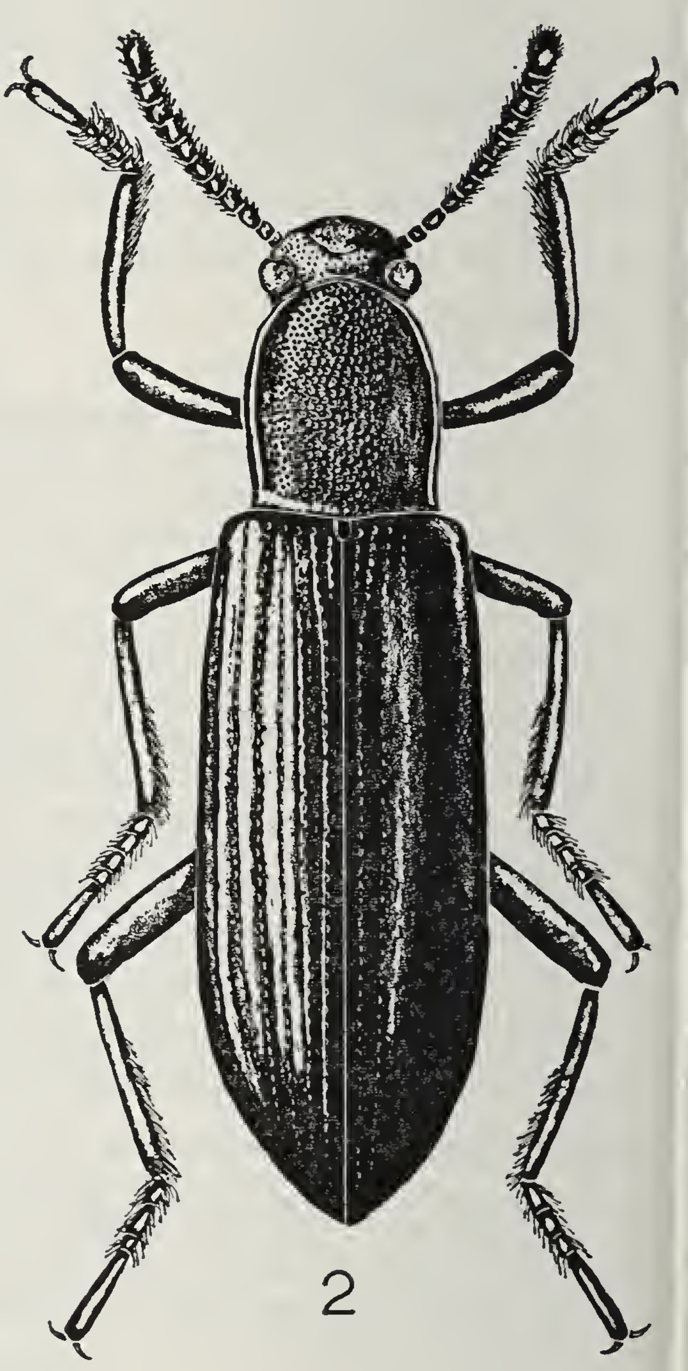


Figure 1. *Talanus mecoscelis,* Female (Allotype).
Figure 2. *Talanus spilmani,* Male (Paratype). Line=5 mm.

Length: 8.0 mm; width: 2.8 mm.

Allotype, female. Similar to male but lacking the denticles on the mesal margin of pro- and mesotibiae; metatibiae with two denticles as in male. Length: 9.2 mm; width: 3.2 mm.

Type Locality: Holotype, allotype, and 3 paratypes labelled Brownsville, Texas, August 8, 1937, D. J. & J. N. Knull. Additional paratypes: (1) Brownsville, Texas, May 25, 1939, D. J. & J. N. Knull; (1) Brownsville, Texas, May 25, 1934, J. N. Knull. The entire type series is placed in the Ohio State University Insect Collection.

Measurements (Paratypes): Length: 7.4-8.4 mm.; width: 2.5-3.2 mm.

Discussion: Talanus mecoscelis can be associated most closely with *T. subexaratus* Mäklin, a species widely distributed in South and Central America. Through the courtesy of Mr. J. Balfour-Browne of the British Museum (Natural History), I was able to study ten specimens, presumably including most of the variations of *T. subexaratus* encountered by Champion. *Talanus subexaratus* is quite different from *T. mecoscelis*. It is smaller (5-7.5 mm., Champion, 1887, p. 326), brownish instead of black, the legs are shorter (the metafemur does not attain the fourth (last) ventral abdominal suture), the tarsi are not as hairy and the distal ends of the tibiae are much more sparsely setose so that the teeth or denticles, when present, are clearly visible.

Champion regarded *T. subexaratus* as a highly variable species but nothing indicates that *mecoscelis* is a mere variant of that species.

Talanus spilmani NEW SPECIES

(Figure 2)

Description—Holotype, male. Elongate, subparallel, slender, dark brown, shining, legs piceous. Head strongly constricted behind eyes, no transverse depression across vertex, a shallow frontal depression delimiting clypeus; surface moderately coarsely and densely punctured, more finely so on clypeus; eyes large, convex, weakly emarginate in front; antennae moderately stout, basal five segments subequal in thickness, third longest, sixth slightly wider, seventh still wider, 8 to 10 slightly wider and subequal in size, eleventh larger, elongate-oval; terminal segment of maxillary palpus large, scalene. Pronotum one-seventh longer than broad, strongly and evenly convex from side to side, lateral marginal bead set off by deep grooves, grooves ending at basal angles but continuing around apical angles and becoming obsolete almost in line with clypeus; lateral margins narrowly but strongly reflexed; sides strongly rounded in dorsal view, broadly and feebly sinuate in basal one-third; apex strongly rounded, angles obtuse and broadly rounded; base feebly bisinuate with middle portion somewhat reflexed, angles nearly rectilinear, not prominent; surface coarsely and densely punctured, a distinct transverse impression near base; ventral surface of pronotum coarsely and densely punctured, prosternum minutely rugulose; prosternal process strongly convex between coxae, apex abruptly deflexed behind.

Elytra moderately coarsely punctate-striate, punctures not in sulci except along suture, and toward apex, individual punctures subequal to width of intervals which are flat and impunctate; epipleural fold inflexed to beginning of terminal abdominal sternum, not attaining apex of elytra. Mesosternum and metasternum coarsely punctured laterally, punctures much finer and more widely spaced on median areas and on abdominal sterna; terminal two abdominal sterna expanded laterally, concealing large portion of epipleural fold. Legs long, metafemora extending caudad approximately to suture separating third and fourth abdominal sterna; all tibiae with a small tooth on mesal margin of distal half, nearly concealed by dense patches of fine yellow setae; tarsi extremely long, five-sixths as long as tibiae on meso- and metathoracic legs, two-thirds as long as tibiae on prothoracic legs. All tarsal segments except apical and penultimate with dense pads of long yellowish setae, penultimate segment of each tarsus with a few long yellowish setae; apical segments more cylindrical and as long as or longer than their respective basal segments combined, with only a few scattered setae beneath; penultimate segment of each tarsus small, cylindrical.

Length: 7.0 mm; width: 2.2 mm.

Allotype, female. Similar to male but lacking the teeth on distal half of tibiae. Length: 7.3 mm; width: 2.1 mm.

Type locality: Holotype, allotype, and one paratype (F) labelled: Biscayne, Florida, May 28, Hubbard and Schwarz (USNM). Additional paratypes: (2M, 3F) Lake Okeechobee, Florida, March 7, 1913, W. S. Blatchley (PU, W. S. Blatchley Collection); (1F) Moore Haven, Florida, March 3, 1918, W. S. Blatchley (PU, W. S. Blatchley Collection); (1M) Cape Sable, Florida, February 22, 1919, W. S. Blatchley (PU, W. S. Blatchley Collection); (1F) Lake Worth, Florida (MCZ, Bowditch Collection); (1M) Lake Okeechobee, Florida, March 2, 1913 (MCZ, N. S. Easton Collection) (3M, 3F) Lake Worth, Florida (CMP, H. W. Klages and John Hamilton Collections). Two of the latter were collected April 14. One specimen from Chokoloskee, Florida, October 20, 1923, W. S. Blatchley (PU, W. S. Blatchley Collection) is not included in the type series because it is somewhat abberant.

Measurements (Paratypes): 5.6-8.0 mm; width: 1.7-2.4 mm.

Discussion: Talanus spilmani has the appearance of a large *T. langurinus* and has frequently been mistakenly identified as that species in the past. Size alone will separate all but one of the specimens I have seen but the relative length of the legs and stouter pronotum in *spilmani* will also distinguish it from *langurinus*. In *spilmani* the width of the pronotum is usually about 90 per cent of the length whereas in *langurinus* this same character averages about 80 per cent.

On several occasions the two species have been collected together, and in the Hamilton collection (CMP) a specimen of each species from Lake Worth, Florida was glued to the same card. It is interesting that no recently collected specimens have shown up in collections; all nineteen known specimens are quite old. This species is named in honor of Mr. T. J. Spilman to whom I am indebted for many favors.

The history of the two previously recognized North American species of *Talanus* is worthy of mention. In 1878 (p. 421) LeConte described the genus *Dignamptus* and the two included species *stenochinus* and *langurinus*, both from Enterprise, Florida. *Dignamptus* was subsequently reduced to a synonym of

Talanus (Jacquelin du Val)[1] by Champion (1887, p. 321). Hamilton (1895, p. 321) quoted Horn (reference not found; possibly a personal communication) to the effect that *langurinus* and *stenochinus* were merely extremes of one species.

Blatchley (1914, p. 143) was apparently misled by this previous lumping of the two species. He realized that there were at least two species of *Talanus* in Florida and described *okeechobensis* as a new species. Fall (1932, p. 148) corrected the situation with the statement that "Blatchley . . . failed to recognize that his species (*okeechobensis*) was precisely the same as LeConte's *stenochinus*."

The four known North American species of *Talanus* may be separated by the following key:

Key to species of Talanus occurring in the United States

1. Body elongate, slender; elytra, in dorsal view, four-tenths or less as wide as long; male with conspicuous tooth on mesal margin of distal half of each tibia, female with tibiae unmodified.................................. 2

1′. Body robust; elytra, in dorsal view, approximately half as wide as long; tibial teeth variable.................................. 3

2. Legs short; metafemora not extending caudad much beyond middle of third abdominal sternum; mesofemora barely extending to base of metafemora; profemora not extending cephalad beyond head; width of pronotum usually less than 85 per cent of length; total length of body seldom exceeding 5 mm.................................*langurinus* (LeConte)

2′. Legs longer; metafemora extending caudad to or beyond suture separating third and fourth abdominal sterna; mesofemora extending beyond metacoxae; profemora extending cephalad beyond head; width of pronotum usually greater than 85 per cent of length; total length of body usually greater than 5 mm.................................*spilmani* NEW SPECIES

3. Pronotum with basal and apical margins strongly beaded, continuous with lateral bead; the bead delimited by deep grooves around perimeter; metafemora extending caudad beyond fourth (last) ventral abdominal suture; male with conspicuous tooth on mesal margin of pro- and mesotibiae and two widely-spaced denticles on metatibiae; female lacking teeth on pro- and mesotibiae, metatibiae with denticles as in male ....*mecoscelis* NEW SPECIES

3′. Pronotum with marginal bead not continuous around perimeter, always interrupted at middle of apical margin; basal marginal bead, if present, poorly defined and not delimited by deep grooves; metafemora never extending caudad to fourth (last) ventral abdominal suture; pro- and mesotibiae with tooth (more conspicuous in male) on mesal margin of distal half, hind tibiae simple in both sexes.................................*stenochinus* (LeConte)

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[1] The genus *Talanus* is often credited to Mäklin (1878, p. 96). Jacquelin du Val (1857, p. 156) described *Talanus cribrarius*, his combination of a described species with a generic name fulfilling the requirements of the International Rules of Zoological Nomenclature, although he did not give a separate generic description. *Talanus cribrarius* Jacquelin du Val is the type of the genus by monotypy. *(Continued bottom of page 38.)*

Several collections have large series of the two previously known species. Since very little has been published on any of the members of the genus *Talanus,* I consider the following data worth recording.

Talanus langurinus (LeConte)

A total of 112 specimens was studied from the following localities: FLORIDA (Brevard, Broward, Collier, Dade, Glades, Hendry, Monroe, Palm Beach, Seminole and Volusia Counties). TEXAS: (Cameron and Hidalgo Counties). Specimens have been taken from February to October and are frequently attracted to lights.

Talanus stenochinus (LeConte)

Sixty-two specimens were studied from the following localities: FLORIDA (Alachua, Broward, Dade, Duval, Glades, Highlands, Indian River, Lee, Levy, Monroe, Palm Beach and Pinellus Counties). LOUISIANA (New Orleans, Opelousas). Specimens have been taken from January to October and are frequently attracted to lights.

Acknowledgments: The specimens upon which this study is based are from the following institutions: Carnegie Museum (CMP), Florida State Collection of Arthropods (FSCA), Museum of Comparative Zoology at Harvard University (MCZ), Ohio State University (OSU), Purdue University (PU), and United States National Museum (USNM). I wish to thank Dr. P. J. Darlington, Jr. and Dr. John F. Lawrence for help in establishing the identity of the two LeConte species of *Talanus* and for the loan of specimens; Dr. Ross H. Arnett, Jr. and Dr. Jeffrey N. L. Stibick for the opportunity to study the W. S. Blatchley specimens, Dr. George Wallace for the loan of specimens, especially those of the John Hamilton collection; Dr. Howard V. Weems, Jr. and Mr. Robert E. Woodruff for a large number of specimens providing valuable distributional data and, finally, Mr. T. J. Spilman for a tremendous amount of effort on my behalf in assuring the accuracy of many statements in this paper and for his enthusiastic support of my taxonomic investigations, both current and past.

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There is presumably a Spanish edition of Jacquelin du Val's work which is cited as both 1856 and 1857, thus making the exact date of publication rather uncertain. In any event, Jacquelin du Val's use of the name *Talanus* antedates that of Mäklin by a number of years.

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Review of South American Genus Belopoeus Schoenherr (Coleoptera, Curculionidae, Rhynchophorinae)

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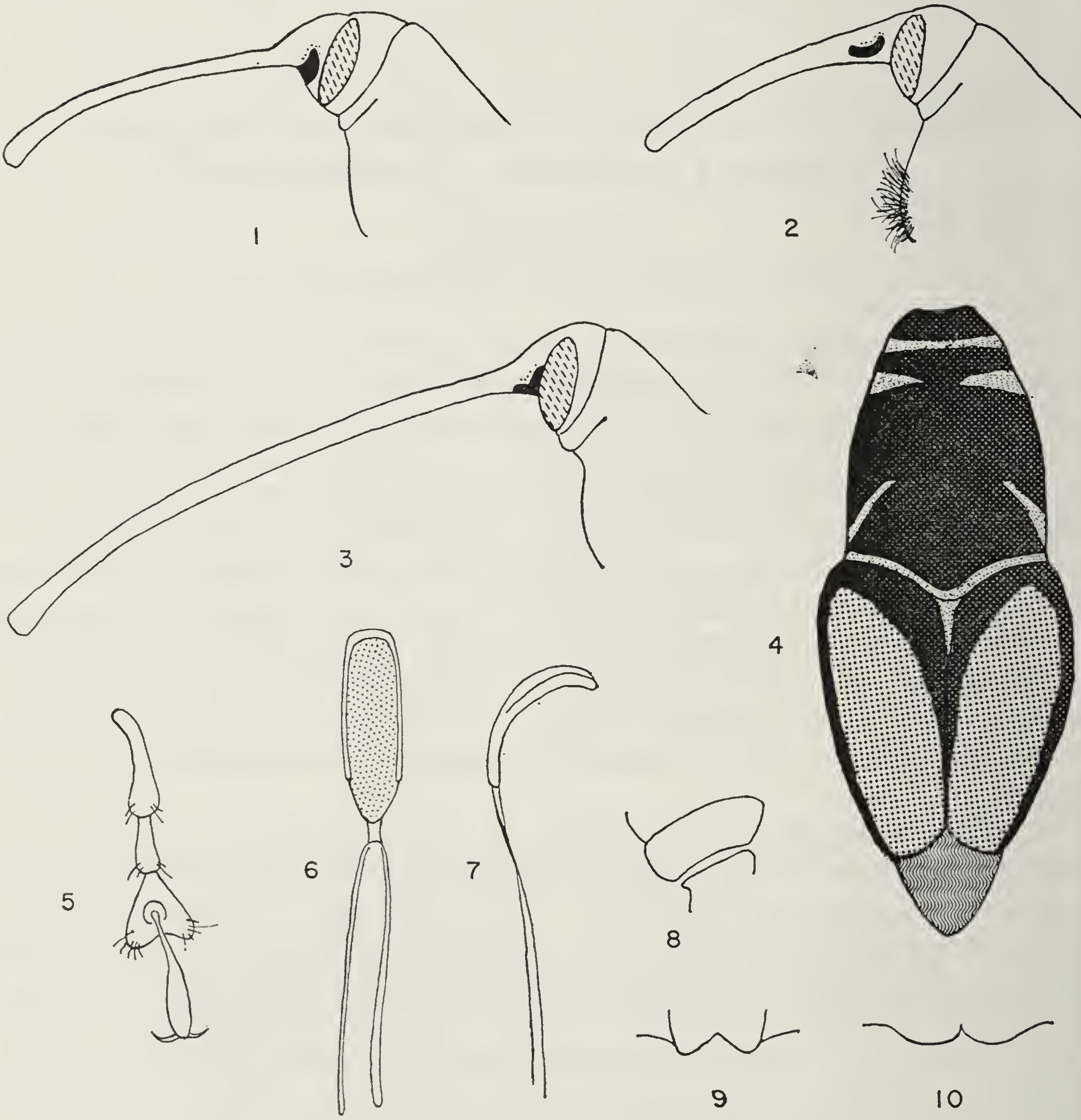
This neotropical genus of three species has never been reviewed in its entirety. Both Schoenherr (1838) and Lacordaire (1866) knew one species only. Arrow (1903) and Bondar (1954) each described one species, but did not discuss the other species. The genus, but not the species, appeared in generic keys published by Faust (1899), Heller (1926), and Vaurie (1967). These are the only references I have found to this group of weevils. Perhaps because they are rare in collections and have been so little studied, the species of *Belopoeus* have been associated for a hundred years with the wrong group of genera. Although the type of the genus was described in *Calandra,* the genus does not belong among the Sitophilini (the "Calandrides vrais" of Lacordaire), as the species do not have the mesepimeron acuminate in front, but as in fig. 8. Rather they are related to *Metamasius* Horn, or, as mentioned by Schoenherr, to *Sphenophorus,* and similar genera.

Specimens of Bondar's species (*orbignyae*) were collected by him from the dead sheaths of the "babaçu" palm, *Orbignya speciosa,* and possibly the other species are associated with this family, as are many species of *Metamasius.* According to Bondar (1954, p. 218), "The life cycle of the species is completed within the spathes of the palm. The adults feed on the pollen and lay the eggs on the inner side of the recently opened spathes. The larvae make galleries lengthwise between the large nervures of the sheath. The life of the insect is thus passed in the crown of the palm, which is probably why the species has up to now escaped the attention of collectors." [my translation]

The species are found on the northeast coast of South America from the vicinity of Belem, Brazil, to French Guiana and Venezuela; one species (*niger*) occurs also in central Brazil at 2600 feet, and in Peru, not far from the coast, northeast of Lima. All the localities are by or near rivers.

Fourteen specimens were examined for this study from the collections of the British Museum (Natural History) [BM], the Departmento de Zoologia, São Paulo [SP], and the American Museum of Natural History [AMNH]. Several more specimens of *carmelitus* have been seen in former years. I express my thanks to Mr. R. T. Thompson of the British Museum and Dr. H. Reichardt of São Paulo for their help in providing cotypes or specimens for comparisons.



FIGURES 1-3. Beaks and prosternum of *Belopoeus*. 1—*orbignyae*, female. 2—orbignyae, male. 3—niger, female. FIGURE 4. *Belopoeus carmelitus*. FIGURES 5-8. Parts of *Belopoeus*. 5—tarsus (from Bondar). 6—aedeagus, dorsal view. 7—aedeagus, lateral view. 8—mesepimeron. FIGURES 9-10. Prosternal process. 9—*B. carmelitus* and *B. orbignyae*. 10—*B. niger*.

Belopoeus Schoenherr

Belopoeus Schoenherr, 1838, p. 872. Type species, by original designation and monotypy, *Calandra carmelita* Germar, 1824.

This genus differs from other rhynchophorine genera in the combination of characters that follows (more diagnostic characters listed first): long, needle-like, cylindrical, virtually straight beak (that of females may be twice as long as pronotum); short elytra with retracted apex (fig. 4) in contrast with long pygidium (nearly as long as one-half of length of elytra); elongate, acutely pointed, triangular scutellum (at base wider than adjacent intervals); hairy prosternal process behind front coxae that overlaps mesosternum; strongly arcuate profile of prosternum that is abundantly hairy in male; longitudinally finely striate sides of first four abdominal segments of female; long antennae inserted at extreme base of beak; six-segmented funiculus of antennae; cone-shaped club of antennae, its spongy apex one-third or less of length of club; elongate peduncle of postmentum under apex of beak; widely separated eyes, both above and below; widely separated front and middle coxae; mesepimeron (fig. 8); bulbous femora; widely dilated (fig. 5), shallowly emarginate third tarsal segment that is spongy-hairy below; elongate second tarsal segment; arcuate aedeagus with faint lateral line that is evanescent behind (fig. 7), apodemes attached to sides of base of aedeagus, and forked behind (fig. 6); length, excluding beak, 7 to 12 mm.

Key to the Species of Belopoeus

1. Elytra at least half red; pronotum black with whitish lines of silky, appressed hairs along base and apex and on sides of disc from base to about middle (fig. 4) .... *carmelitus* Germar

1′. Elytra (virtually) and pronotum (entirely) black, without appressed white hairs 2

2. Pronotum scarcely punctate except in basal third where two parallel, longitudinal rows of from six to eight punctures; prosternal process at apex sharply angular (fig. 9); beak of female slightly longer than pronotum (fig. 1) .... *orbignyae* Bondar

2′. Pronotum uniformly finely punctuate; prosternal process at apex gently sinuate (fig. 10); beak of female twice length of pronotum .... *niger* Arrow

Belopoeus carmelitus (Germar)

Calandra carmelita Germar, 1824, p. 296, Brazil; type probably in Halle, Germany.

Diagnosis: Told at once from the other species by the color and vestiture as stated in the key, also by having the pygidium strongly tumid at middle and the basal margin of the pronotum lobed at middle.

Length, including pygidium, but excluding beak, 7 to 8.5 mm., beak of female, 4 to 5 mm. Beak slightly bent downward in apical third or fourth; beak of male slightly longer than pronotum, sparsely, finely punctate; upper edge with short hairs; in profile slightly wider at base, and flat on upper edge at base; basal dilation (seen from above) distinctly longer than wide; of female about one third longer than pronotum; in profile slightly wider at apex, bulbous at base; impunctate, glabrous; basal dilation as wide as long. Pronotum about as long as elytra at middle line, punctures obscured by velvety surface, base strongly lobed at middle; color black, with whitish pattern (fig. 4) of hairs at apical constriction, on basal margin, and in two short basal lateral stripes. Elytra, striae punctate; color mostly red, but with black laterally and in large triangular patch from base to about middle, suture black (fig. 4), some specimens with whitish lines of appressed hairs along base and on basal part of suture. Scutellum as long as one fourth or one-fifth of length of elytra. Pygidium distinctly tumid medially from near base to apex.

Under side well punctate, with curving whitish line of hairs from apical constriction to sides of front coxa and along base of prosternum, whitish hairs also on mesepimeron and most of metepimeron, in front of hind coxa, and on side of first abdominal segment; prosternal process triangularly emarginate; male with metasternum and first abdominal segment concave and hairy, prosternum at middle hairy, tibiae on inner edges hairy.

In contrast to the other two species, the black of *carmelitus* is velvety and opaque rather than shiny. The hairs on the upper edge of the beak of the male are not present in *orbignyae* (I have no male of *niger*); the hairs on the prosternum are spread out uniformly, not in tufts as in *orbignyae* males.

Lacordaire (1866) said that the whitish dorsal and ventral vestiture was composed of scales, but it appears to me to be silky, decumbent hairs.

Specimens Examined: *Venezuela:* Caripito, July 5, 1912, 1 male (AMNH). *French Guiana:* Cayenne, 1 male, 1 female (BM). *Brazil:* 1 male, 1 female (BM); Mangabeira, Mocajuba, Para, November, 1952 (Orlando Rego), 1 female (AMNH). A specimen from *Peru* was seen at the British Museum.

Belopoeus orbignyae Bondar

Belopoeus orbignyae Bondar, 1954, p. 216, figs. 1, 2, Bacabal, state of Maranhão, Brazil; no type designated.

Diagnosis: Except for its black color, with which it agrees with *niger*, this species is more similar to the red and black *carmelitus*. Differs from both species in the punctation of the pronotum and in the long, dense, whitish hairs of the pygidium.

Length, including pygidium, but excluding beak, 8.5 to 9 mm., beak of female about 4 mm. Beak slightly bent downward in apical third or fourth; of male (fig. 2) slightly wider at base when seen in profile; about as long as pronotum; distinctly punctate; in profile flat at base; basal dilation (seen from above) longer than wide; of female about one-fourth longer than pronotum; impunctate; in profile slightly wider at apex and bulbous at base (fig. 1); basal dilation as wide as long. Pronotum black, about as long as elytra, very finely punctate except at basal third where two parallel rows of larger punctures; base obtusely rounded. Elytra black, striae distinctly punctate. Scutellum about one-fifth of length of elytra. Pygidium slightly tumid at center, covered with long, dense, thick, white hairs.

Under side well punctate; prosternal process triangularly emarginate; one of 5 specimens examined with white tomentosity on mesepimeron, metepimeron, and sides of first abdominal segment; male with metasternum and first abdominal segment concave, and with long hairs, as on pygidium; male prosternum at middle with long hairs forming two large tufts, and tibiae on inner side ciliate.

The two hairy tufts on the prosternum of the male (fig. 2) resemble, in profile, a giant powder-puff. The hairs on the pygidium, under side, and legs are longer than those of the other species, and the prosternum is more tumid.

A female cotype has the same appressed whitish tomentosity on the under side as is characteristic of *carmelitus*. Bondar did not mention this, but he did notice the peculiar striations of the abdomen of the female, which I find are present in the other two species also.

Although Bondar's 28 cotypes were said to be deposited in six institutions, there are no cotypes in at least two of them, the American Museum of Natural History and the Field Museum, Chicago.

Specimens Examined: *Brazil:* Maranhão, October 15, 1952 (Bondar), 2 males, 1 female (BM); Bacabal, Maranhão, October 25, 1952 (Bondar), 1 male, 1 female (cotypes) (SP). All collected on *Orbignya speciosa,* a palm.

Belopoeus niger Arrow

Belopoeus niger Arrow, 1903, p. 252, pl. 28, fig. 5, "Chapada, Para," type, female, from Chapada, Mato Grosso, Brazil, in British Museum (Natural History), examined.

Diagnosis: Differs from the other two species by having the apex of the prosternal process behind the front coxae (fig. 10) scalloped or sinuate, not angular; the beak of the female longer (fig. 3); the pronotum proportionally shorter in relation to the length of the elytra; and the pygidium not at all tumid. Male not known.

Length, including pygidium, but excluding beak, 10 to 12 mm., beak of female, 8 to 8.5 mm. Beak of female very slightly arcuate, twice length of pronotum, impunctate, glabrous; in profile slightly wider at apex, bulbous at base; basal dilation (seen from above) wider than long. Pronotum black, shorter than elytra, sparsely, finely punctate, at base virtually straight. Elytra black or black with faint red apices; striae not visibly punctate. Scutellum one-fifth or one-sixth of length of elytra. Pygidium feebly convex.

Under side punctate on sides of middle and at apex, but scarcely punctate elsewhere; prosternal process feebly sinuate.

The specimen from Para, as stated by Arrow (1903), has the beak as long as the pronotum and elytra combined. The beak of *niger* is reminiscent of that of some myrmecine weevils, although those weevils have the beak flattened, not cylindrical. The antennae are inserted so close to the eye that the basal dilation is shorter than wide.

Arrow assumed, correctly, that both his specimens were females. My specimen from Satipo, Peru, is unfortunately also a female; I compared it directly with the type.

The locality of the type specimen, Chapada, is now called, according to Bokermann (1966, p. 103), Chapada dos Guimarães. It is situated at about 30 kilometers northeast of Cuiaba, at about 800 meters of altitude.

Specimens Examined: *Brazil:* Chapada, Mato Grosso, 2600 ft., November, 1902 (A. Robert), one female (type); Para (Bates), one female (both BM). *Peru:* Satipo, Jauja, May, 1948 (Paprzycki), one female (AMNH).

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FIELD NOTES

AMPHIZOA LECONTEI Matthews (Amphizoidae) were collected during the period Aug. 13 to 15, 1963 in the middle fork of the Popo Agie River, Sinks Canyon, about 5 miles south of Landers, Wyoming at an elevation of about 6500 feet. At this point the stream was quite rapid and rather cold. The entire catch of 11 adult specimens were found in foam covered pockets of calm water surrounded by rocks along the shore. Each of these pockets had water flowing into them, though in some instances at a slow rate. An average of about 1 hour was spent for each specimen collected. Ten of the adults were found clinging to pine debris (male flowers), only one was found on the side of a rock. One adult, when dropped into the water, made feeble swimming motions, but progressed slowly by these efforts. Pools were examined which contained abundant pine debris but no foam, no beetles were found in these situations. The size of the pools in which specimens were found varied from about 2 square inches to about 4 square feet.—RICHARD E. WHITE, U. S. Dept. of Agriculture, Washington.

Revision of the Tribe Chalepini of America North of Mexico. I. Genus Xenochalepus Weise (Coleoptera: Chrysomelidae)[1]

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Introduction

The North American species of the tribe Chalepini have not received comprehensive taxonomic treatment since the revision by Horn (1883). Most of the literature on this tribe is fragmentary and scattered. Some of the species are not well known and there is little in the literature to depict their geographical distribution. The names recently used for some species have been incorrectly applied. Contributions by Chapuis (1875), Spaeth (1937), Uhmann (1940), and others ignored old genotype designations or have shifted recent generic names without fixing their type-species. Some species have been incorrectly synonymized by previous workers. Judging from the above facts, it seems a review of this group at the present time is warranted.

This revision of *Xenochalepus* is the first in a proposed series reviewing the six genera of Chalepini of America North of Mexico. Many of the data on biology reported here are from unpublished notes in the late H. S. Barber's file. They are acknowledged in the text where they occur.

Methods

The male genitalia, found to be diagnostic for the species, were prepared for study by treatment with KOH, and stained with Gage's stain in the manner suggested by Arnett (1947). Illustrations were prepared with the aid of a "Tri-Simplex Microprojector" or an ocular reticle.

The general distribution given for each species is based on the specimens that I have examined. Undoubtedly more extensive collecting would increase the known range of many of the species. No attempt (except in case of *Chalepus hebalus* Sand. and *Sumitrosis lateritia* (Smith, 1886)) was made to cite the records given in the literature, because of the uncertainty of many of the identifications.

The measurements described below were found to be useful in certain instances for separating the sexes of a species or for segregating the species. The measurements were taken as follows: Total length (Fig. 1) was taken from the apex of the frontal carina to the apex of the elytra. Pronotal length (P. L.) was measured from the anterior to posterior margin along the midline; elytral length (E. L.) was the distance between the basal and apical margins of elytra. Pronotal width (P. W.) and elytral width (E. W.) were taken at the widest part of the body.

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[1] From a dissertation submitted in partial fulfillment of the requirements for the Ph.D. degree at the Catholic University of America, Washington, D. C., 1966.

Classification

Tribe Chalepini

This tribe is considered to be a very large one, consisting of about 24 genera from all parts of the world. The Junk Catalogue (Uhmann, 1964) lists only five genera for North America. In this study the genus *Odontota* Chevrolat, is readopted and a new generic name *Sumitrosis* is proposed for the species incorrectly assigned to *Anoplitis* Kirby, 1837, with *Hispa rosea* Weber, 1801, here designated as its type species.

Based on a study of the external anatomy and the male genitalia of more than 6,700 specimens the tribe is found to contain six North American genera: *Anisostena, Sumitrosis, Baliosus, Chalepus, Odontota,* and *Xenochalepus.* Only *Xenochalepus* is considered for taxonomic revision in this paper.

Diagnostic and Key Characters of Adults

Characters of diagnostic value for separating taxa of this tribe are associated with the color of the body, size, shape and color of the clypeus, shape of the frontal carina, dentation of the mandibles, sulci on the antennae, interocular width, lateral margins of the pronotum, elytral striae and male genetalia.

The interocular width is a useful character expressed by a comparison between the maximum width of one eye and the smallest distance between the eyes.

The striae should be counted at the base of the elytra. Some species have the striae anastomosing near the middle or apex of the elytron.

The male genitalia provide some of the most useful taxonomic characters. The length of the flagellum offers the best diagnostic character for separating the genera as well as the species. The relative size of the basal foramen and width and shape of its dorsal wall offer useful characters. Shape of the apical orifice, lateral plates, and length of strut, are extremely useful in distinguishing between closely allied species.

The males are smaller than the females and the mesotibia of the male has a small, subapical, conical tooth which the female lacks. The 5th visible sternum of the female has an irregular patch of setae on either side of the central elevation, whereas in males it is hardly perceptible.

Relative proportions of parts are frequently referred to in the key and descriptions, and it is essential that a microscope with an ocular reticle be available so that these characters can be used.

Plate I. Figs. 1-9.

Fig. 1. Dorsal view of *Xenochalepus potomaca* n. sp. Fig. 2. Elytral apices of *Odontota floridanus* n. sp. Fig. 3. Elytral apices of *Xenochalepus robiniae* n. sp. Fig. 4. Apex of last tarsal segment of *Xenochalepus omogera* (Crotch). Fig. 5. Apex of last tarsal segment of *Xenochalepus potomaca* n. sp. Fig. 6a-6c. Male genitalia of *Xenochalepus omogera* (Crotch). Fig. 6d. Female spermatheca of *Xenochalepus omogera* (Crotch). Fig. 7. Female spermatheca of *Xenochalepus potomaca* n. sp. Fig. 8a-8c. Male genitalia of *Xenochalepus robiniae* n. sp. Fig. 9a-9d. Male genitalia of *Xenochalepus ater* (Weise).

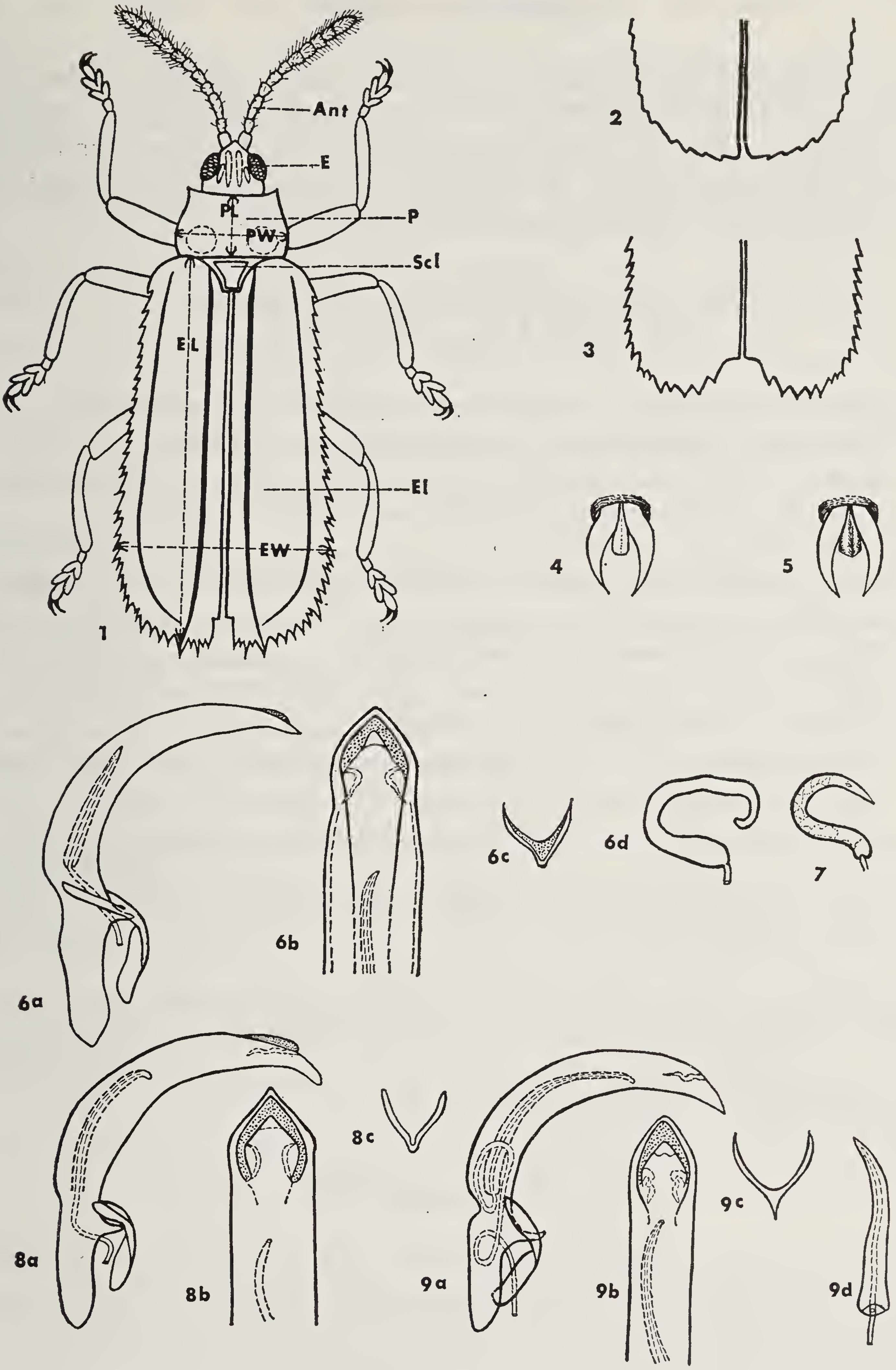


PLATE I

List of Abbreviations

Ant, antenna
E, eye
El, elytron
EL, elytral length
EW, elytral width
P, pronotum
PL, pronotal length
PW, pronotal width
Scl, scutellum

Explanation of Figures

The drawings of the genitalia pertaining to the same species have been given the same number with the addition of letters, a, b, c, d, to distinguish the different views and parts: a, lateral, or slightly dorsolateral, view of aedeagus and tegment; b, dorsal, or dorsocaudal, view of aedeagus; c, spiculum gastrale, usually dorsal, or dorsocaudal view; d, flagellum or female spermatheca.

Key to Genera of North American Chalepini

(Modified from Arnett, 1963)

1 Elytra each with eight or eight and one-half rows of punctures 2

1′ Elytra each with ten or ten and one-half rows of punctures 3

2 Body slender, nearly cylindrical; eyes feebly swollen, at least not projecting out farther than side of neck; mesotibiae strongly bent .... *Anisostena Weise*

2′ Body broader, very wide at shoulders; eyes more or less swollen; mesotibiae straight or weakly bent .... *Sumitrosis* n. gen.

3 Clypeus yellow, smooth or micropunctate .... *Baliosus* Weise

3′ Clypeus black, rarely with yellow margin, rough, thick and finely punctured, or coarsely granularly punctate 4

4 Form elongate; each elytron with ten striae at base .... *Chalepus* Thunberg

4′ Form oval or cuneiform; each elytron with eleven striae at base 5

5 Apices of elytra regularly rounded, sutural angles rectangulate (Fig. 2) .... *Odontota* Chevrolat

5′ Apices of elytra conjointly rounded, sutural angles deeply subquadrate-emarginate (Fig. 3) .... *Xenochalepus* Weise

The generic name *Odontota* Chevrolat, 1837, was long used for our species and is correct. The new generic name *Sumitrosis* is proposed for the species incorrectly assigned to *Anoplitis* Kirby, 1837. The reasons for these generic changes will be given in the parts dealing with those genera.

Genus Xenochalepus Weise

Xenochalepus Weise, 1910:136; 1911 (a):26; 1911 (b):35, 38; Leng, 1920:303; Uhmann, 1936:614; 1938:420; Blackweider, 1939:64; Uhmann, 1940:144; 1947:115 ,125; Monrós and Viana, 1947:193, 229; Arnett, 1963:915, 940.

Type Species of Genus. Xenochalepus omogera (Crotch), 1873:81, by present designation.

Diagnostic Features of Genus. Clypeus and frons very prominent. Clypeus quadrate and distinctly margined; surface tuberculate, very rugose; raised prominently; base angulate and very close to base of antennae. Pronotum with baso-lateral torulose on either side of posterior depression. Elytron distinctly bicostate; 2nd interspace strongly, the 8th moderately, costate; 4th interspace not costate. Each elytron with ten and one-half rows of punctures. Sutural angles of elytra conjointly emarginate.

Description of Genus. Species cuneiform, robust; length from 7.2 to 8.0 mm.; males generally larger than females.

Head slightly wider than long; vertex sulcate. Surface between antennae elevated into longitudinal ridge reaching base of clypeus. Interocular width variable. Basal antennal segment always incrassate and inserted dorsally before the middle of length of eye. Clypeus large; surface generally raised as whole; base angulate and ventral of antennal insertion; surface sculpturing rugged to rugulose. Labrum prominent; broader than long: outer margin of each mandible rather broadly and evenly arcuate. Eyes convex, large and elongate-oval in form. *Pronotum* broader than head and wider than long; conic in dorsal aspect with base generally wider than apex; lateral margins bisinuate and angulate at middle; dorsum transversely convex and slightly depressed posteriorly with ante-scutellar transverse ridge; surface generally coarsely foveo-punctate; interstices usually cristate; with smooth baso-lateral torulose present on either side of posterior depression. Torulose of variable size and color. Last tarsal segment produced between bases of claws into a narrow, triangular, truncate process. Elytra elongate-ovate; apices conjointly rounded and deeply subquadrate-emarginate at suture; with lateral and apical margin serrulate; each elytron with ten and at extreme base with eleven rows of punctures. *Abdomen* sparsely micro-punctate; apex of fifth visible sternum slightly emarginate; generally 5th sternum of female with small irregular patch of setae on either side of central elevation and in males patch scarcely perceptible.

Male Genitalia. Aedeagus from moderately to heavily selerotized and showing considerable curvature from below. Basal foramen fairly large; with posterio-ventral border prominent and subtriangular. Median lobe tapering distally to subacute point. Apical orifice large and V-shaped. Apical hood large, triangular with acute posterior end. Strut keeled and flattened dorsally. Flagellum stout, broad basally and gradually tapering into an acute posterior end. The speculum generally U-shaped.

Distribution. The distribution of this genus is as follows: UNITED STATES, Maryland, Virginia, Texas and Arizona, BRITISH WEST INDIES, MEXICO, CUBA, GUATEMALA, NICARAGUA, COSTA RICA, PANAMA, COLOMBIA, VENEZUELA, SURINAM, FRENCH GUIANA, BRAZIL, ECUADOR, PERU, BOLIVIA, PARAGUAY, URUGUAY, ARGENTINA.

Discussion. This very homogenous genus is represented in the United States by four species: X. *omogera* Crotch; X. *robiniae* n. sp.; *X. ater* Weise; and *X. potomaca* n. sp. The clear strong generic characters facilitate rapid separation from other genera in the tribe Chalepini. The prominent, quadrate clypeus with the coarsely tuberculate surface and the distinctly bicostate elytra with the sutural angles conjointly emarginate are diagnostic. The elytral characters will separate it from the anatomically similar genus *Odontota*, in which the elytra are distinctly tricostate and the sutural angles not emarginate. The close relationship between the two is indicated by the prominence of the clypeus and frontal ridge, presence of ten and one-half rows of punctures on each elytron, and the structure of the male genitalia.

Nomenclatural Notes. Xenochalepus Weise (1910) as originally proposed included four specific and four subspecific names. The Fabrician name, *Hispa dentata,* was not originally included and the citation of that name as genotype by Uhmann (1940:144) is invalid. I, therefore, designate *Xenochalepus omogera* (Crotch, 1873) as type of the genus *Xenochalepus* Weise, 1910. This species was placed by Spaeth (1937:151) in his new subgenus *Hemichalepus* for which the type species was not designated. *Chalepus (Hemichalepus) holdhausi* Spaeth, 1937, is designated here as the type species of *Hemichalepus.*

Key to the Species of Xenochalepus of North America

1 Antennal segments 3-6 relatively stout, coarsely irregularly sulcate and carinate; a groove over the frontal carina absent; lateral pronotal margins obtusely angulate; apex of last tarsal segment between the bases of claws feebly sulcate (Fig. 4): Eastern Mexico to Costa Rica .... *omogera* (Crotch)

1′ Antennal segments 3-6 more slender and less deeply sulcate; a groove over the front carina present; lateral pronotal margins angulo-subrotundate; apex of last tarsal segment between the bases of claws deeply cleft (Fig. 5) 2

2 Prosternum yellow; pro and mesofemora yellow at basal one-third; pronotal medial line absent; mandibles distinctly bidentate; Washington, D. C. on wild bean vine .... *potomaca* n. sp.

2′ Prosternum, pro and mesofemora black; pronotal medial line well-defined; mandibles usually unidentate 3

3 Antennal segments 3-6 smooth, shining, sulci hardly perceptible; pronotum wholly red, (rarely posterior depression infuscate), lateral sides not piceous; Arizona on native locust .... *robiniae* n. sp.

3′ Antennal segments 3-6 feebly shining with stronger sulci; pronotal posterior depression and lateral sides piceous; Arizona, on soybeans .... *ater* (Weise)

1. Xenochalepus omogera (Crotch, 1873)

(Fig. 4; 6, a, b, c, d; Plate II)

Odontota omogera Crotch, 1873:80; Horn, 1883:295. (Location of type: Museum of Comparative Zoology, Cambridge, Massachusetts.)
Type Locality. Tampico, Mexico.

Odontota palliata Chapuis, 1877:8; Baly, 1886:84. (Synonymized). (Location of type: Musee Royal del' Afrique Centrale, Brussels, Belgium.)
Type Locality. Mexico.

Chalepus omogerus (Crotch), Baly, 1885:49; 1886:83; Champion, 1894:239.

Chalepus (Xenochalepus) omoger (Crotch), Weise, 1910:143; 1911 (a):28; 1911 (b):38.

Xenochalepus omoger ab. *palliatus* (Chapuis), Uhmann, 1930:249; 1938:424; 426.

Xenochalepus deficiens Uhmann, 1930:247; 1938:424, 426; (Synonymized); 1950: 337; (Location of type; United States National Museum, Washington, D. C.) *Type Locality.* Costa Rica.

Xenochalepus (Hemichalepus) deficiens (Uhmann), Spaeth, 1937:151, Uhmann, 1957:97.

Xenochalepus (Hemichalepus) omoger (Crotch), Spaeth, 1937:151; Uhmann, 1957:96.

Xenochalepus omogerus (Crotch), Uhmann, 1964:420.

Xenochalepus subomoger Uhmann, 1937:66; 1938:426; Maulik, 1937:137; Uhmann, 1957:97. (NEW SYNONYMY).

Type Locality. Lacaja, near San Jose, Costa Rica.

Diagnostic Features. This species resembles *X. potomaca* in color, size, and shape, but may be readily separated from the latter by the presence of the following characters.

Antennal segments 3-6 relatively stout, coarsely, irregularly sulcate and carinate; a groove over the front carina absent; lateral pronotal margins obtusely angulate and entirely black; the apex of last tarsal segment between the bases of claws feebly sulcate.

Description of Species. Male. Texas, Webb Co., Laredo. (USNM).

Length 7.5 mm.; width 2.6 mm.; cuneiform; robust. *Head* length/width ratio, .777; vertex quadrisulcate, sulci close to eyes well-defined, short and deep; median sulci shallow, broad and vestigeous. Frontal carina narrow, feeble and joins clypeal base; groove over the frontal carina not present. Antennae 2.5 mm. long; antennal joints 3-6 robust, coarsely, irregularly sulcate and carinate; rotula at the base of 1st segment; basal segment incrassate, cylindrical, broader than long; segments 2-6 obconic; 2nd shorter than 1st; 3rd subequal in length to the preceding two combined; 6th equal in its length and width. Clypeus large; with only apical two-third semi-circular area raised; ventral surface rugged. Labrum prominent, broader than long, apical margin arcuate and sparsely micro-rugose. Mandibles prominent, unidentate; apical tooth obtuse. Eye width equal to transverse width of clypeus at apex and slightly wider than dorsal interocular width. *Pronotum* transverse; length .9 mm.; width 1.6 mm.; base wider than apex; widest basally, lateral margins obtusely angulate at middle and bisinuate. Dorsum transversely convex, depressed posteriorly with ante-scutellar transverse ridge; surface coarsely and deeply foveo-punctate; interstices cristate. Pronotum with small baso-lateral torulose on either side of basal depression. Medial line well-defined with shallow longitudinal groove. Mesosternal length/width ratio, .656. Meso- and metatibia of male without subapical tooth; last tarsal segment produced beween bases of claws into a narrow truncate process; process with apex feebly sulcate. Scutellum longer than broad at apex; widest basally; lateral margins gradually narrowing towards apex; apical margin truncate and subarcuate medially. *Elytra* elongate-ovate; length 6.5 mm.; width 2.6 mm.; slightly dilated posteriorly; outer margin distinctly serrulate more coarsely so posteriorly and on the apical border; punctures of elytra generally rounded and large, but slightly transverse towards base in first four rows and small towards apex in first stria near suture. Each elytron bicostate; 2nd interstice smooth and strongly costate; 8th interstice moderately costate; 8th interstice apically feebly tuberculate; 4th interstice and basal and apical portions of 6th interstice also feebly costate. *Abdomen* sparsely micropunctate; 5th sternum apically subtruncate, slightly emargination perceivable and in male scarcely perceptible setae on either side of the medium elevation.

Color. Interocular space with small rufo-fulvous patch anteriorly. Pronotum bicolored; with large median black vitta, width confined to posterior depression and narrowing behind anterior pronotal margin; lateral margin of pronotum black; the dark area narrowing to anterior and posterior angles of pronotum; remaining area of pronotum uniformly orange-yellow. Neck ventrally and prosternum orange-yellow. Profemora with a basal two-fifths orange-yellow ring. Elytra black, the humeral one-fourth of the elytral length with an elongate yellow triangular area extending from the base of the 1st costa to the lateral elytral margin. Abdomen with narrow bright yellow vitta at lateral sides.

Male Genitalia. Aedeagus considerably sclerotized and showing greater curvature from below (Fig. 6a). Basal foramen large, slightly less than one-fourth the length of aedeagus. Lateral plates of apical hood large and irregular (Fig. 6b). Tegmen U-shaped, each arm elongate, lateral sides nearly parallel, subapically broad and apex acute. Strut long, close to foramen, keeled and flattened dorsally. Flagellum stout, broad basally and gradually tapering into an acute posterior end; length of flagellum less than one-fourth the length of aedeagus. Spiculum (Fig. 6c) U-shaped and somewhat asymmetrical.

Female. Spermatheca as shown in Fig. 6d. Fifth abdominal sternum with a small, irregular patch of setae on either side of central elevation.

Biology. Maulik (1937) reported the food-plant as wild bean vine (Vitaceae).

Variation and Discussion. Size variation is as follows: male: total length 7.3-7.7 mm.; elytral length 6.0-6.5 mm.; width 2.6-3.0 mm.; female: total length 8.1-8.2 mm.; elytral length 7.0-8.0 mm.; width 3.2-3.4 mm. The total length of the males is less than the females, and thus shows sexual dimorphism of total length.

No topotypes of X. *omogera* are available but a series of 21 specimens from the vicinity of Cordoba, Mexico, are believed to be this species. Their basal antennal segments (especially segments 3-6) are very roughly sculptured with irregular short sulci separated by sharp carinae and because of these phalanged ridges, appear robust. The orange-yellow basal areas of the elytra varies in this series from small humeral spot, supposed to be typical of *X. omogera* Crotch, to involve the basal third of the elytra as found in *palliata* Chapuis, 1877.

Xenochalepus subomoger Uhmann, 1937, was based upon 42 specimens. All except one from Chiapas were from Lacaja, near San Jose, Costa Rica, on *Fabacea* sp. (Fagaceae). The additional Costa Rican specimens before me seem to be referable under this name, a few others agree better with *X. deficiens* Uhmann, 1930, but these seem to be merely degrees of extension of the flavescence and unworthy of separation from the true *omogera* Crotch. For these reasons I consider this as a synonym of *X. omogera.*

Baly (1886:84) was correct in uniting *omogera* with *palliata* and Uhmann (1938:424) with *deficiens* on the basis of color variations.

Distribution. The distribution of *Xenochalepus omogera* Crotch, is indicated on Plate II.

Specimens Examined. 10: 6 males and 4 females. Texas: Webb Co., Laredo, 5 males, 3 females, (USMN). No further data: 1 male, 1 female, F. C. Bowditch collector, (MCZ).

2. Xenochalepus potomaca new species

(Fig. 1; 5; 7; Plate II)

Diagnostic Features. Antennal segments 3-6 slender, feebly shining with stronger vestiges of sulci; mandibles distinctly bidentate; narrow elytral margin will serve as recognition characters for this species.

Holotype. VIRGINIA, Arlington County, near Chain Bridge (WASHINGTON, D. C.), July, 1918, H. S. Barber collector; female, Type No. 69138, deposited in the United States National Museum Collection.

Host Plant. Phaseolus polystachios (L.), (wild bean vine).

Description of Holotype. Length 7 mm.; width 2.9 mm.; cuneiform. *Head* length/width ratio, 0.8; vertex tetrasulcate; sulci close to eyes are short, narrow and deep; median sulci broad and shallow, the latter changes anteriorly into a narrow carina which extends as a knife-like septum between the antennae and joins the clypeal base; groove above the front carina present. Antennae 2.3 mm. in length; segments 3-6 slender, less deeply sulcate and feebly shining with stronger vestiges of sulci; 2nd and 3rd segment cylindrical and slightly expanded apically; segments 4-6 obconic; 1st longer than 2nd; 3rd about twice the 2nd or 4th segment. Labrum very prominent and quadratus; about two-thirds broader than length; dorsum transversely convex with ground sculpturing. Mandibles prominent, distinctly bidentate; distadentis large, acute and sharp; proxadentis small and acute. Eye transversely wider than the width of clypeus and equal at dorsal interocular space. *Pronotum* transverse; length 1.0 mm.; width 2.2 mm.; conic; base wider than apex; widest medially; lateral margins angulosubrotundate at middle, narrowing anteriorly and parallel posteriorly; bisinuate; dorsum transversely convex, slightly depressed posteriorly with antescutellar transverse ridge; foveo-punctate less developed; interstices subcristate, sparsely alutaceous, shiny medially and with ground sculpturing laterally. Medial line ill-defined. Legs normal, last tarsal segment produced between bases of claws into a narrow triangular truncate process, its apex deeply cleft (Fig. 5). Scutellum at apex broader than length; lateral margins parallel at one-half from apex; sinuate; apical margin truncate, subemarginate. *Elytra* elongate-ovate; length 6.0 mm.; width 3.3 mm.; slightly dilated posteriorly; lateral and apical margin serrulate; punctures of elytra small, rounded almost similar in size; each elytron with second interspace strong, smooth, the eighth moderate, feebly serrated, costate; 4th and 6th interspaces with microscopically tuberculate but not costate. *Abdomen* with 5th sternum apically emarginate and in female with a small irregular patch of setae on either side of the central elevation.

Color. Yellow markings consist of a spot on the vertex, a pair of broad sublateral pronotal areas confluent along anterior margin above and involving the prosternum below, as well as joining the small humeral spot; anterior femora yellow at basal one-third, meso-femora feebly spotted at base; a median longitudinal yellow vitta on mesosternum; sides of abdomen narrowly margined with yellow.

Genitalia. Male was not observed in the collection. Female spermatheca as shown in Fig. 7, which may be distinguished from *X. omogera.*

Paratypes. 14: all females. VIRGINIA, Arlington Co., near Chain Bridge, Aug. 19, 1916, Snyder and Barber collectors, reared from *Phaseolus polystachios,* 3 females, (USNM); Va., near Chain Bridge, July, 1918, H. S. Barber, 8 females, (USNM); Va. near Chain Bridge, T. E. Snyder and J. N. Knull collectors, reared, VII-21-1916; (USNM).

Additional Specimens Examined. 22: all females. VIRGINIA: Arlington Co., near Chain Bridge, Aug. 10, 1916, 12 females, Snyder and H. S. Barber, (USNM); July, 1918, 9 females, H. S. Barber, (USNM). MARYLAND: Plummers Island, Nov. 26, 1905, 1 female, W. L. MacAnee, (USNM).

Biology. "A colony found by T. E. Snyder in woods facing the Potomac River in July, 1916, ..." was several times visited and the type series was reared by the late H. S. Barber, from blotch mines of *Phaseolus polystachyus* in the same locality in July, 1918. "One paratype was found on Nov. 26, 1905, near Plummers Island, Md., by W. L. MacAnee, and others were found by J. C. Bridwell, about 1928, on the same host plant near Barcroft, Va., and reared from mines in its leaves, but these samples are not at hand." (Unpublished data from H. S. Barber.)

Variation and Discussion. The size variation is as follows: total length 7.0-8.0 mm.; elytral length 6.0-6.5 mm.; width 2.9-3.2 mm.

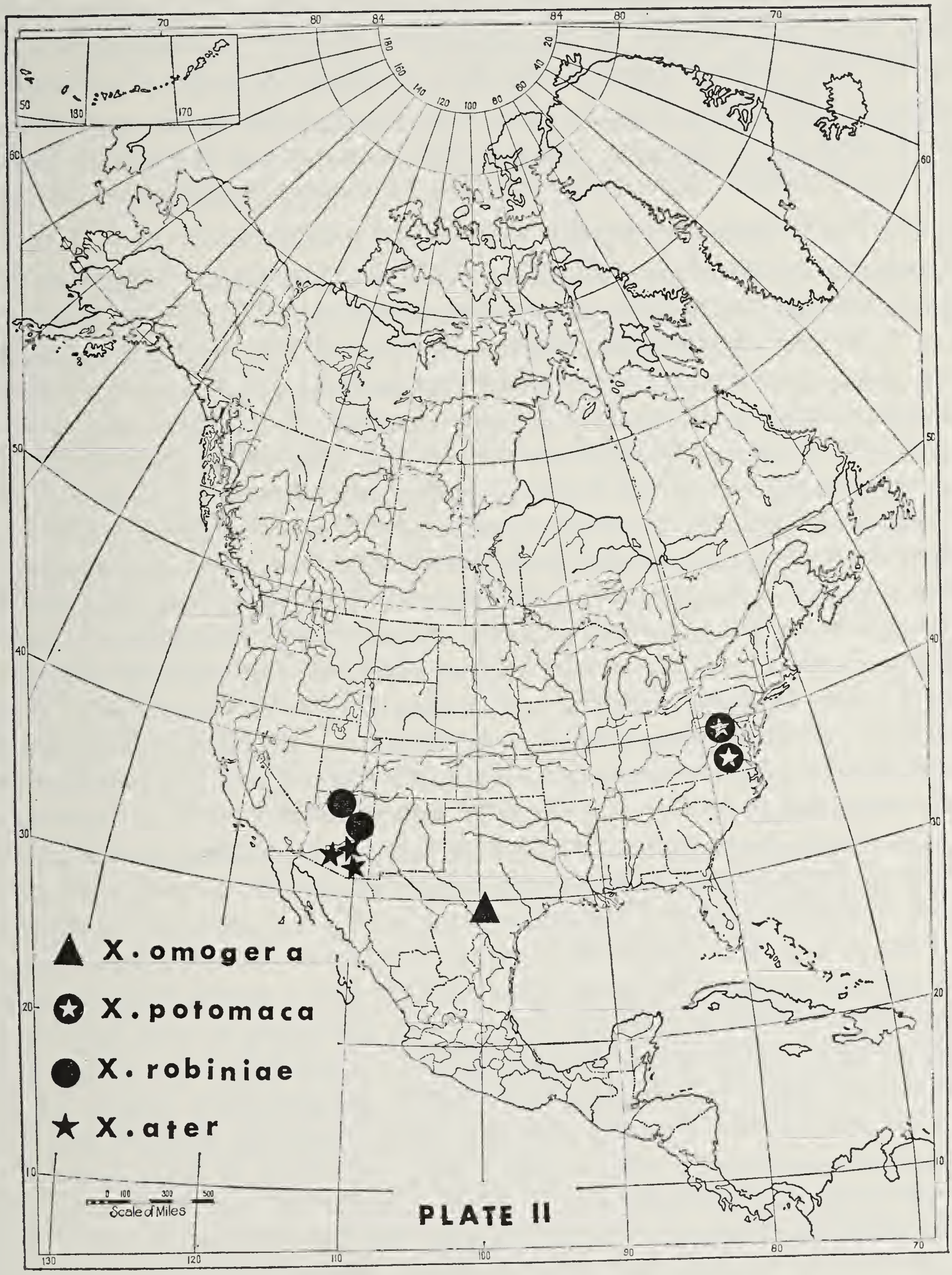
The length of humeral yellow spot varies from a small spot to one-fourth the length of elytra. Meso- and metafemora coloration near base may be varied from a broad yellow ring to a feebly yellow spot or absent.

Form, sculpture and color pattern much as in *X. omogera* Crotch, but the smaller, shining, feebly sulcate and alutaceous basal antennal joints, contrast with the larger, subopaque, rugosely carinate sculpture on segments 3-6 of *X. omogera.* The sculpture of the pronotum is less distinct, the basolateral prominence, the alutaceous surface and the fovaolate punctures being less developed in the new species. The elytra are similar in surface sculpture, but the margin is less expanded, the lateral and apical teeth as well as the apical emargination are much smaller.

Distribution. The distribution of *Xenochalepus potomaca* n. sp., is indicated on Plate II. This species is known from Maryland and Virginia, and it has been collected from late July to late November, but mostly in August.

Plate II.

Distribution of species of *Xenochalepus*.



3. Xenochalepus robiniae new species

(Fig. 3; 8, a, b, c; Plate II)

Diagnostic Features. Pronotum and vertex red; a very small red basal elytral spot on the fourth interstice behind the pronotal callus, rarely a basal median infuscate area on the pronotum; antennal segments 3-6 slender, cylindrical, smooth, shining with faint vestiges of the alutaceous sculpture containing decumbent scale-like hairs; aedeago-flagellum less than one-third the length of aedeagus.

Holotype. ARIZONA, Coconino Co., Oak Creek, 5,500 ft. alt., near Flagstaff, May 16, 1916, L. N. Gooding collector and received from the late B. P. Clark; male; Type No. 69137, deposited in the United States National Museum Collection.

Host Plant. Robinia neomexicana Gray, (Native locust).

Description of Holotype. Length 7.0 mm.; width 2.6 mm.; cuneiform. *Head* length/width ratio, .875; vertex tetrasulcate; anteriorly with a median longitudinal carina, becoming slightly wider, diamond-shaped at a point above the antennal bases; carina extends as a sharp, narrow septum between antennae and joins the clypeal base; a groove above the front carina present. Antennae 2.4 mm. in length; segments 3-6 slender, cylindrical, smooth, shining with faint vestige of the alutaceous sculpturing and with a few very shallow punctures containing decumbent scale-like hairs; 2nd and 4th nearly equal and 1.2 times longer than 1st; 3rd twice the 1st. Clypeus large, prominent, pentagonal and its margins well-defined; ventral surface coarsely and irregularly tuberculate. Labrum prominent, broader than long; apical margin arcuate and sparsely micro-granulose. Mandibles prominent, unidentate, apical tooth acute. Eye transversely equal the width of clypeus and dorsal interocular space. *Pronotum* transverse; length 1.0 mm.; width 1.7 mm.; conic; base wider than apex; widest medially; lateral margins angulosubrotundate at middle, narrowing anteriorly and obliquely more so posteriorly; dorsum transversely convex, depressed posteriorly with ante-scutellar transverse ridge; surface coarsely, deeply foveo-punctate; interstice subcristate, shining medio-anteriorly and with ground sculpturing in posterior depression. Medial line well-defined with shallow longitudinal groove. Mesotibia of male with a prominent triangular subapical tooth; hind tibia with a small triangular tooth at one-third from apex; last tarsal segment produced between bases of claws into a narrow truncate process, its apex broadly bifid to meet the flexed claws. Scutellum at apex broader than length; widest basally; lateral margins parallel at one-third from apex; sinuate; apical margin truncate, subemarginate. *Elytra* elongate-ovate; length 5.4 mm.; width 2.6 mm.; slightly dilated posteriorly; apices conjointly rounded and deeply subquadrate-emarginate at the suture (Fig. 3); punctures of elytra rounded and generally large, but distinctly small toward apex in first row near suture; each elytron with 2nd interspace strong, smooth, the 8th moderate, feebly serrate, costate; the basal and apical portion of the 6th interspace with a feebly, microscopically tuberculate-carinate. *Abdomen* with 5th sternum apically slightly emarginate and in male hardly perceptible setae on either side of median elevation.

Color. Subopaque, black; the pronotum, vertex and a very small red basal elytral spot on the fourth interstice behind the pronotal callus; rarely a basal median infuscate area on the pronotum; abdomen narrowly margined with pale yellow at sides.

Male Genitalia. Aedeagus heavily sclerotized and showing considerable curvature from below (Fig. 8a). Basal foramen large, slightly less than one-fourth the length of aedeagus. Lateral plates of apical hood large and regular (Fig. 8b). Tegmen V-shaped, each arm short, subapically broad and apex subacute. Strut short, not close to foramen, keeled and flattened dorsally. Flagellum stout, broad at base and gradually tapering into a curved, acute posterior end. Length of flagellum slightly less than one-third the length of aedeagus. Spiculum V-shaped, emarginate at the base (Fig. 8c).

Allotype. Same data as holotype. Female. Length 7.5 mm.; width 3.0 mm. Female is somewhat larger than that of the male. The prominent, triangular, subapical tooth on meso- and metatibia absent. On 5th visible sternum a small irregular patch of setae on either side of the central elevation.

Paratypes. 46: 19 males, 22 females, 5 sex undetermined. Paratypes are designated from the following localities: ARIZONA, Coconino Co., Oak Creek, 5,500 ft. alt., near Flagstaff, May 16, 1916, L. N. Gooding collector for B. P. Clark, on Native Locust, 7 males, 9 females, (type locality) (USNM). Three other paratypes were collected on the same host plant at Williams, Coconino Co., Arizona, 7,000 ft. alt., June 9, 30 and July 29, 1901 by E. A. Schwarz and H. S. Barber, (USNM). Two paratypes are labeled with Mingus Mt., Arizona, I-IX-1925, W. W. Jones, (USNM). Manzanta Camp, Oak Creek Cyn., Coconino Co., Arizona, 5,000 ft., July 26, 1950, T. Cohn, P. Boone and M. Cazier collectors, 10 males and 9 females, (AMNH). 17 mi. S. Flagstaff, Oak Creek Cyn., Coconino Co., Arizona, 6,000 ft., July 27, 1950, T. Cohn, P. Boone and M. Cazier collectors, 1 male and 3 females, (AMNH). Baboquivari Mts., Browns Cyn., Pima Co., Ariz., VIII-5-1952, M. Cazier and R. Schrammel collectors, 1 male and 1 female, (AMNH).

Biology. This species has been collected on *Robinia neomexicana* Gray (Native locust), in Arizona at Mingus Mt., Oak Creek, 5,500 ft. and Williams, 7,000 ft. altitude from May 16th to Sept. 1. (H. S. Barber, Unpublished).

Larvae. Unknown.

Variation and Discussion. Size variation is as follows: Total length: males 6.8-7.0 mm.; females 7.3-7.6 mm.; elytral length: males 5.4-5.7 mm.; females 5.7-6.1 mm.; elytral width: males 2.6-2.8 mm.; females 2.8-3.0 mm. The total length of the males studied is considerably less than the length of the females, and thus shows striking sexual dimorphism of total length.

Uhmann (1938:426), has included *arizonicus* Uh. in the key to the species of *Xenochalepus.* But I have transferred this species into the genus *Odontota* Chevrolat, as the apices of the elytra is regularly rounded and is not subquadrate-emarginate.

Distribution. The distribution of *Xenochalepus robiniae* is indicated on Plate II. This species is known from Arizona, and it has been collected from middle of

May to early September, mostly in July. The above localities could indicate mountain top distribution from 5,000 to 7,000 ft. altitude.

4. Xenochalepus ater (Weise, 1905)

(Fig. 9, a, b, c, d; Plate II)

Chalepus omoger ab. *ater* Weise, 1905:134. (Location of type: probably in the Zoologischen Museum der Universitate Berlin.)
Type Locality. México.

Chalepus (Xenochalepus) ater (Weise), 1910:144; 1911 (a):26; 1911 (b):38; Leng, 1920:303.

Xenochalepus ater ab. *crotchi* Weise, 1910:144; 1911 (a):26; 1911 (b):38; Leng, 1920:303; Uhmann, 1938:426. (Synonymized). (Location of type: probably in the Zoologischen Museum der Universitate Berlin.)
Type Locality. México.

Chalepus ater (Weise), Jones and Brisley, 1925:174; Böving and Craighead, 1931:66; Pallister, 1953:81.

Chalepus (Hemichalepus) ater (Weise), Spaeth, 1937:151.

Xenochalepus (Hemichalepus) ater (Weise), Uhmann, 1938:424; 1957:94; 1964: 420.

Diagnostic Features. This species resembles *X. robiniae* in size, and shape, but may be separated from the latter by the following characters:

Antennal segments 3-6 feebly shining with stronger sulci; pronotum fulvous to rufo-fulvous and usually lateral margins piceous; aedeago-flagellum less than one-third the length of aedeagus, strut short and not close to foramen.

Description of Species. Male. Arizona, Santa Cruz Co., Pena Blanca, (USNM).

Length 7.3 mm.; width 3.0 mm.; cuneiform. *Head* length/width ratio, 0.75; vertex quadrisulcate, all sulci well-defined and deep; carina between sulci sparsely alutaceous; groove over the front carina short and shallow. Antennae 2.4 mm. segments 3-6 slender, feebly shining, with stronger vestiges of sulci; basal segment incrassate; 2nd and 3rd cylindrical; 3rd slightly expanded apically; segments 4-6 obconic; 1st and 2nd subequal in length; 3rd equal in length to the preceding two combined; 4th larger than 5th. Clypeus large, quadrate, raised as a whole; ventral surface coarsely and irregularly rugosissimus. Labrum considerably prominent; broader than length; apical margin subarcuate and sparsely micro-rugose. Mandibles prominent; feebly bidentate; apices of distadentis large, obtuse and sharply arcuate; cutting edges broad and sharp. Eye transversely equal to the width of clypeus and wider than the dorsal interocular space. *Pronotum* transverse; length 1.1 mm.; width 2.0 mm.; conic; base wider than apex; widest medially; lateral margins bisinuate, angulo-subrotundate at middle, narrowing obliquely toward base and more so toward apex; dorsum transversely convex, depressed posteriorly with ante-scutellar transverse ridge; surface coarsely, densely foveo-punctate; interstice cristate, shining, alutaceous medio-anteriorly and microreticulate ground sculpturing in posterior depression and laterally. Medial line well-defined with shallow longitudinal groove. Mesosternal length/width ratio, 0.351. Mesotibia of male with a prominent triangular subapical tooth; metatibia with a prominent triangular tooth at one-third from apex. Last tarsal segment produced between the bases of claws into a narrow truncate process; its apex broadly bifid to meet the flexed claws. Scutellum length and width at apex subequal; widest basally, lateral margins subparallel at one-third from apex; sinuate, apical margin truncate, emarginate. *Elytra* elongateovate; length 5.8 mm.; width 2.8 mm.; apices conjointly rounded and deeply subquadrate-emarginate at the suture; apical limb distinctly explanate; outer margin distinctly serrulate, more coarsely so posteriorly and on the apical border; punctures of elytra rounded, large and almost similar in size; each elytron with second interspace strong, smooth, the eighth moderate, feebly serrulate, costate; the basal portion of 6th interspace also slightly elevated. *Abdomen* with 5th sternum apically subtruncate, excindate sublaterally and scarcely perceptible setae on either side of central elevation.

Color. A small rufo-fulvous patch on anterior interocular space. Pronotum bicolored; posterior depression and usually lateral sides piceous; the remaining area of pronotum fulvous or rufo-fulvous. Elytra black, except a small basal spot on the fourth interstice behind the pronotal callus from fulvous to rufo-fulvous. Abdomen with narrow bright yellow vitta at lateral sides.

Female. A groove over the front carina is long, deep and extends beyond interocular space. The 5th abdominal sternum with a small, irregular patch of setae on either side of central elevation.

Male Genitalia. Aedeagus moderately sclerotized and showing considerable curvature from below (Fig. 9a). Basal foramen small, nearly equal to one-fifth the length of aedeagus. Lateral plates large and irregular (Fig. 9b). Tegmen V-shaped, each arm short, lateral sides subparallel and apex obtuse. Strut long, bent upward into foramen, keeled and flattened dorsally. Flagellum stout, broad at base and gradually tapering into an acute, arcuate apex (Fig. 9d); length of flagellum slightly less than one-half the length of aedeagus. Spiculum U-shaped and symmetrical (Fig. 9c).

Biology. Jones and Brisley (1925) recorded this species as mining in the leaves of a common cultivated bean (*Phaseolus vulgaris*, L.) in southern Arizona near Douglas and also in the Huachuca Mts. Jones reported it as abundant on soybeans at Douglas, Arizona, in August and September, 1942. "Peltier reared specimens from mines in leaves of string bean at Nogales in July, 1943, and again in August, 1945." (From H. S. Barber, unpublished data.)

Larvae. Böving and Craighead, 1931:66, has described and illustrated on plate 115 the larvae of *Chalepus ater* Weise:

"Eighth pair of abdominal spiracles well-developed, dorsal and annular, eighth abdominal segment terminal, with free hind margin." (Slightly modified after Böving and Craighead.)

Variation and Discussion. Size variation is as follows: total length: males 7.2-7.3 mm.; females 7.6-7.7 mm.; elytral length: males 5.7-5.8 mm.; females 5.8-6.0 mm.; elytral width: males 2.8-3.0 mm.; females 3.2-3.3 mm. The total length of the males studied is considerably less than the length of the females, and thus shows striking sexual dimorphism of total length. Lateral margins of scutellum subparallel at one-third from apex in the specimens examined, but in some specimens, lateral margins gradually narrowing toward apex. The ratio of length/width at the apex of scutellum is variable; in some specimens, especially in females, the width is less than the length. Coloration of the prosternum is black, but in some specimens there is a small, median, longitudinal evanescent fulvous vitta between the pro-coxae.

Weise (1905) proposes the name *ater* for the melanic individuals from four localities in Mexico, which he considers a mere aberration of *Chalepus omoger* Crotch. Weise (1910) distinguishes between *omoger* (-*palliatus* Chapuis, 1877) of eastern Mexico and the form from the Mexican plateau which he considers a distinct species to be known as *Chalepus (Xenochalepus) ater* Weise, 1905, and proposes a new name *crotchi* for the abbreviation in which the yellow thoracic marks are developed. Spaeth, 1937:151, includes *ater* Weise, and *omogera* Crotch, in the key to species comprising his new subgenus, *(Hemichalepus)* of *Chalepus.* Uhmann in 1938, elevates *Xenochalepus* to generic rank including the subgenus *Hemichalepus* Spaeth.

Distribution. The distribution of *Xenochalepus ater* is indicated on Plate II. This species is known from Arizona and western Texas. It has been collected from middle of May to early October, mostly in July and August. The following localities indicate mountain top distribution.

Specimens Examined. 282: ARIZONA: Cochise Co., Chiricahua Mts., Cane Crk., 2 (CAS); Douglas, 1 (CAS); Carr Cn., 31 (CAS); Miller Cn., 14 (CAS); Palmerless, 7 (USNM); Huachuca Mts., 2, (USNM), 5 (CAS), 10 (AMNH), 8 (UKL), 2 (CU), Pima Co., Santa Rita Mts., 42 (CAS), 116 (UKL), from 5,000 to 8,000 ft. alt. Santa Cruz Co., Pena Blanca, 10 (USNM); Patagonia, 1 (CAS); Santa Rita Mts., Madera Cn. 5 (CAS). Gila Co., Sierra Ancha Mts., 4 (CU). No further data: 11, Morrison, Hibbard & Schwarz, (USNM); Senator, 2, Van Dyke, (CAS); Megas Mts., 2, Van Dyke, (CAS); 6, J. W. Green, (CAS); Garces, 2, Banks, (MCZ); 7, Liebeck, (MCZ). TEXAS: Jeff Davis Co., Davis Mts., 1, Van Dyke, (CAS); Ft. Davis, 1, (MCZ).

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Recently Introduced Beetles in the Pacific Northwest

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Brown (1967) has recently commented on the continuing introductions of European Coleoptera into the Atlantic Provinces of Canada and in the Puget Sound region of Washington and British Columbia. In these areas there are few native beetles pre-adapted to the steppe-like conditions of farmland and urban areas, and these habitats are consequently open to invasion by more or less synanthropic European species.

The species listed below include at least one new to North America, two or three previously introduced in eastern Canada, and two which have spread transcontinentally. Identifications were made by the author, and in several cases were confirmed by W. J. Brown.

Bembidion lampros (Hbst.) Washington: Lynden, Whatcom Co., June 1964, November 1967. This occurrence is only a few miles from the Langley Prairie, B. C. locality (Hatch, 1953), but is the first record for the United States. Specimens were taken in flood debris and in red-cedar litter, both on clay substrate. The species also occurs in Newfoundland.

Rugilus rufipes Germ. Washington: Seattle, June 1965, November 1966; Lynden, Whatcom Co., November 1967. This is the first North American record for this species. It was found on shaded, muddy ground and in a river drift line. It is attracted to carrion.

Sepedophilus testaceum (F.) Washington: Seattle, February 1965, meat bait, one specimen. This identification, based on a dissected male, is *S. testaceum* as defined by Strand (1966). This is the first record of the European species in North America, but Brown (*in litt.*) has found this or a related species in the Atlantic Provinces of Canada.

Coccinella undecimpunctata undecimpunctata L. Washington: Seattle, since June 1965; Redmond, King Co., July 1967. As indicated by Robert (1962) in Quebec this species is most abundant in mid-summer. Since its introduction it has become the most common coccinellid in disturbed situations in Seattle. I have found it also in grass at a salt-water beach, its normal habitat in Europe. It has continued its spread in eastern Canada, and Brown (*in litt.*) gives the following new records: Nova Scotia; Sydney, 1965; Ontario: Grimsby; Vineland Station; Dunnville; Niagara Falls; all in 1962.

Aphodius haemorrhoidalis (L.) Washington: Lynden, Whatcom Co., since 1964; Montana: numerous localities in Lake Co., Mineral Co., and Ravalli Co., all in 1967. This species has become transcontinental.

Apion longirostre Oliv. Washington: Soap Lake, Grant Co., May 1966, 1967. Oregon: Mitchell, Wheeler Co., October 1966, in hollyhock seeds. These records are the first in the Northwest for this rapidly expanding species. At Soap Lake it possibly breeds in a native mallow, *Sidalcea* sp.

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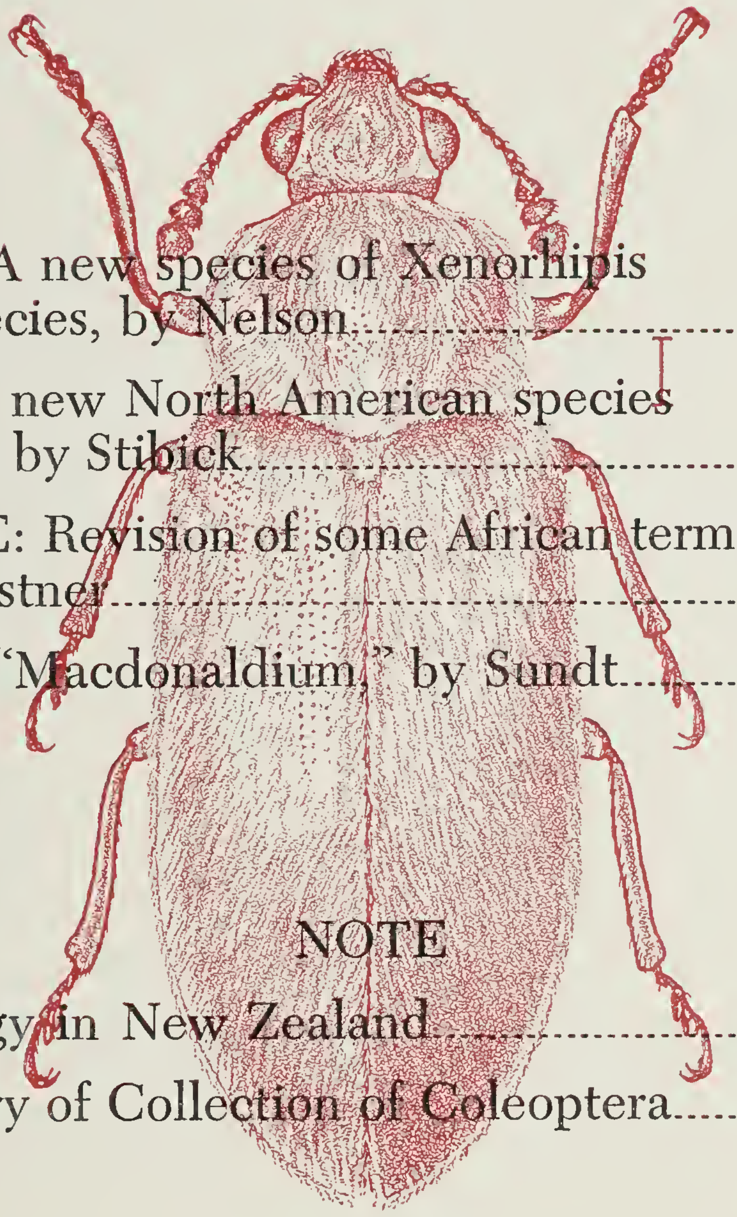

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DEPARTMENT of ENTOMOLOGY

Purdue University – Lafayette, Indiana

THE COLEOPTERISTS' BULLETIN

Founded 1947 by Ross H. Arnett, Jr.

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Revision of the African species of the termitophilous tribe Corotocini (Coleoptera, Staphylinidae) II. The genera *Termitomimus* Tragardh and *Nasutimimus* new genus and their relationships[1]

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Introduction and Taxonomic History

The genus *Termitomimus* was first described and placed in the subfamily Aleocharinae in a very interesting paper by Trägårdh (1907) based upon material he collected in Zululand. In the same paper he reported the histological work he did on the species during which he found 2 types of glands: The cephalic glands at the posterior of the head which open by fine pores in the cuticle; and, the prothoracic glands which open at the cuticular fold between the head capsule and the anterior edge of the pronotum. Thus from the start, *Termitomimus* was known to contain glands in these 2 regions.

Interestingly enough, Trägårdh did not find glands in the abdomen of these insects and attributed the physogastry of the abdomen to the hypertrophy of the fat body. He noticed the resemblance of the recurved abdomen to the general shape of termite nymphs and interpreted the curved abdomen as being a tactile facsimile of a termite. I have recently commented on the mimicry theory with reference to another genus and species of termitophile (Kistner 1968), where the resemblance is more striking but this resemblance also holds true for at least some species of *Termitomimus* and *Nasutimimus* (see Figs. 2C, 4A, 5A, and 6A) and I believe it is apparent to some extent in all species although the photographs are designed to show taxonomic features and not to show the resemblance to termites. Trägårdh also stated that the neck-shaped portion of the abdomen (called the pseudothorax) might facilitate the movement of the pseudohead which contains the male genital organs to facilitate coition, which, because of the morphological modification, would by necessity have to occur face to face. The terms pseudocaput, pseudothorax, and pseudoabdomen were invented by Trägårdh to denote the 3 principle areas of the abdomen, separated by constrictions, in its recurved position over the dorsum of the beetle. These terms are retained here as useful descriptive devices, even though Trägårdh's ideas on mimicry have not, as yet, been tested vigorously. The histology of the insect, especially that of the abdomen, should also be restudied eventually using modern fixation and staining techniques.

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[1] This study was financed in part by the National Science Foundation (Grant No. NSF-GB-6284).

Warren (1920) found additional specimens of the genus near Pietermaritzburg and also found what he considered to be the larva, although to my knowledge he never described it.

No more related specimens were captured until Professor A. E. Emerson collected 65 specimens from *Nasutitermes* nests in the Congo in 1948. These were described as new species by Seevers (1957).

Since 1963, Dr. W. G. H. Coaton and his colleagues have been watching very carefully for termitophiles in their termite surveys of the Republic of South Africa and its dependency, South-West Africa. As I studied the 265 specimens sent me, it became apparent that the entire genus should be revised and the 2 species from *Nasutitermes* nests should be placed in a new genus. This then is the purpose of this paper.

Methods

Although I have opened literally hundreds of *Trinervitermes* and *Nasutitermes* nests and collected many termitophiles, such of which are far rarer than *Termitomimus* sp., it has not been my lot to collect any of these species. I just have not been at the right place at the right time. Mr. J. L. Sheasby, who has collected many of them, told me that the technique I was using was the correct one. This consists of breaking up the nests, knocking out the contents of the pieces into a tray, and then watching for them.

Most of the laboratory methods used have been described in earlier papers (Koblick and Kistner, 1965 and Kistner, 1966). Because of the fragility of the specimens, certain deviations were made. The specimens cannot be allowed to dry out as the shape of the specimens changes radically when even a small amount of drying occurs. Thus all specimens were photographed in alcohol. To do this a small amount of petroleum jelly is placed on the bottom of a syracuse dish. The next hour or 2 is then spent getting as many of the little bubbles out of the petroleum jelly as possible by pushing them out with a needle under alcohol. The specimen is then anchored in the petroleum jelly and positioned under a binocular microscope. It can then be photographed in the usual manner.

All specimens should be preserved in alcohol and kept in fluid when stored. Fixation in the field should be in alcoholic Bouin's fluid. Dried specimens can be somewhat rehydrated by allowing them to soak in water for a day or so prior to study. Due to conditions beyond my control, all of the specimens of *Termitomimus seeversi* n.sp. and *T. vanderlindei* n.sp. were dried when I received them so the photographs are of rehydrated specimens. This is the reason for the bubble within the abdomen of *T. seeversi* (Fig. 5C).

The specimens had to be measured somewhat differently than normal staphylinids because of the recurved abdomens. The following are the definitions of the measurements reported in this paper. Head length is the length of the head measured from the most anterior part of the dorsal border to the most posterior part of the dorsal border. Because the head shape is constant this results in a midline measurement taken from the lateral view. Similarly, the pronotum length is a midline measurement taken from the lateral view. Maximum length of the pseudocaput is the distance between sternite VI and the end of the abdomen taken from the lateral view. Maximum length of the pseudothorax is the distance between sternite V and sternite VI taken from the lateral view. The length of sternite III is the distance from the beginning of the abdomen to the end of the sclerite III in *Termitomimus*; the functionally equivalent measurement in *Nasutimimus* is the distance from the beginning of the abdomen to the functionally posterior end of the abdomen, i.e., the point of curvature. The maximum widths of the pseudocaputs and pseudothoraxes are the only measurements taken from the top of the specimen and are self-explanatory.

Locations where samples were taken are indicated as follows: 13 mi. ex Pretoria-Pienaars River. This means 13 miles from Pretoria on the road to Pienaars River.

The computer programs used for numerical analysis were originally written in FORTRAN II and were run in that form for this study. Since then the programs have been rewritten in FORTRAN IV and now, with the help of Mr. L. Neil Bell, Applications Analyst for Control Data Corporation, are written in extended FORTRAN. Many people have contributed to the evolution of these programs, including Mr. Herbert Jacobson, now in the Department of Biology, University of Victoria, Mr. Robert Banfill, now with IBM, Mr. L. Neil Bell, and myself. All this has taken place in a little over 3 years. So no program is published with this paper, as I am sure that the programs will be still further altered as I add new features or programs based on the writings of Wilson (1965) and Talkington (1967). Anyone wishing copies of these programs will be sent current print-outs upon request.

Genus *Termitomimus* Trägårdh

Termitomimus Trägårdh, 1907: 173; Fenyes, 1918: 60; Warren, 1919: 101; Kemner, 1925a: 17; Kemner, 1925b: 108; Seevers, 1957: 153.

Type of the genus: Termitomimus entendveniensis Trägårdh (Blackwelder, 1952: 378).

Distinguished from all other genera by its distinctive abdomen. Closely related to *Termitopullus* Reichensperger through the pronotum shape, head shape, and the shape of the mouthparts but easily distinguished from it through the extensive membranous development of the abdomen. Closely related to *Nasutimimus* new genus by the membranous development of the abdomen but distinguished from it by the extensive sclerotization of the ventral part of the abdomen in the vicinity of sternite III (compare Figs. 2 and 7).

Overall body shape as in Figs. 2-5. Head narrower in front than behind, slightly longer than broad, with a median posterior hyaline triangle. Eyes present, well-developed, both forward and laterally directed. Antennae inserted between the eyes. Gula very narrow anteriorly, becoming very wide at the base. Mentum-submentum small, rectangular in shape. Clypeus very short. All mouthparts except for the maxillae are extremely small; the maxillae are somewhat reduced. Labrum extremely small, reduced to a very thin dorsal flap. Mandibles reduced and shaped as in Fig. 1A, with no median teeth. Maxillae shaped as in Fig. 1B, palpi 4-segmented but with the fourth segment reduced to where it almost looks like a seta. Labium extremely small, palpi appear to be 1-segmented as reported by

Trägårdh, even under 440x magnification. Antennae 11-segmented, shaped as in Fig. 1C, with 2 coeloconic sensillae on the apical segment.

Pronotum subquadrate, slightly wider than the head, slightly longer (16%) than wide, with a median hyaline triangle at the anterior edge, somewhat physogastric. The base of the triangle is at the anterior border and the apex in the midline of the pronotum slightly anterior of the center. Prosternum small, with an evenly rounded ventral median bulge. Mesothoracic peritremes modified into strap-like sclerites closing the procoxal cavities behind and helping to support the membranous areas of the posterior thorax. There is some enlargement of the membranes attaching the thorax to the head and the membranes attaching the pronotum to the rest of the thorax. Meso- and metasterna without a sharp line of demarcation, appearing completely fused. Mesosternal intercoxal area wide and without a carina. Both meso- and metacoxae are set widely apart. Elytra normal, without distinction. Wings reduced to small membranous flaps, useless for flight. Legs shaped as in Figs. 1D, 1E and 1F. Note the enlarged and lengthened shape of the coxae of the hind leg, such that the coxa is very similar to that of the mesoleg in shape, and a major departure from the usual flat subtriangular shape found in other Aleocharinae. Tarsal formula 4-4-4.

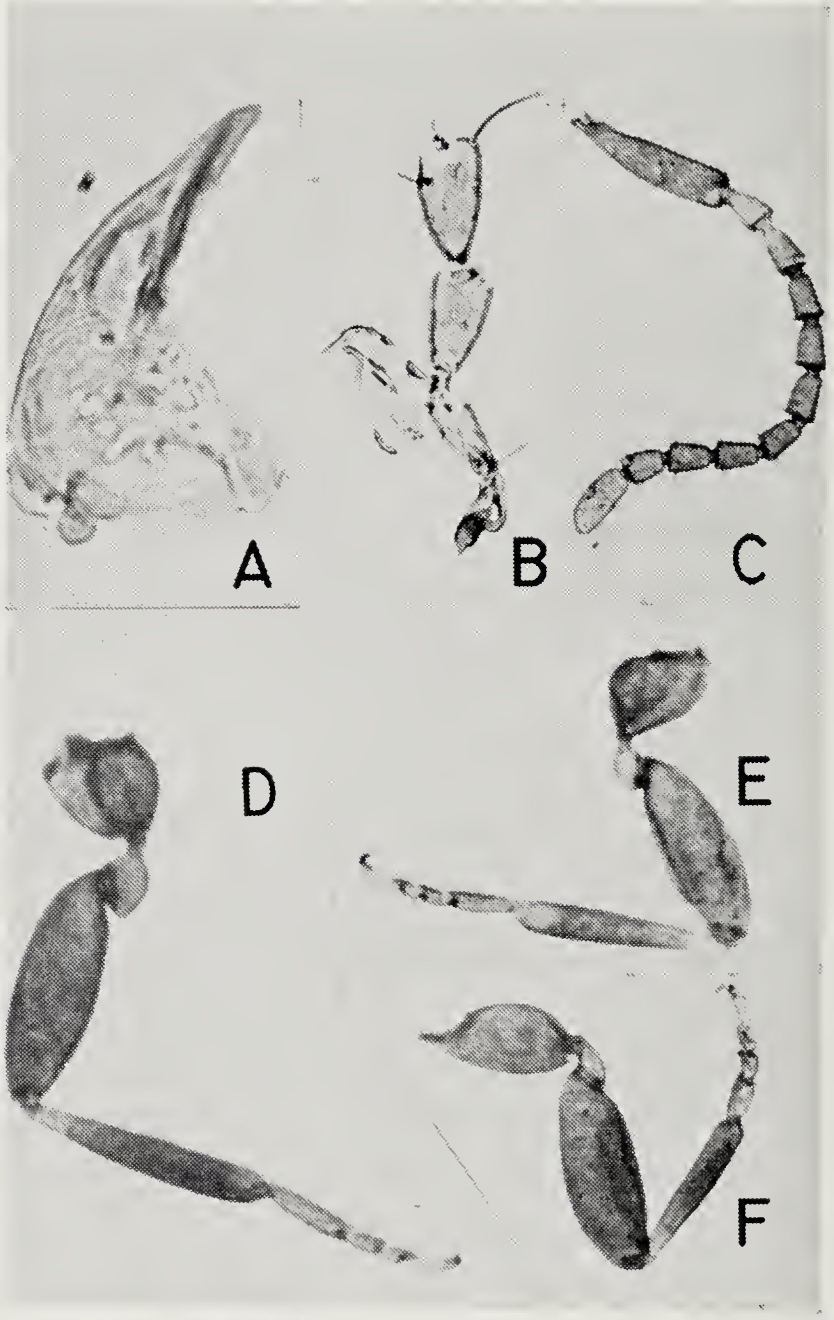

Fig. 1. *Termitomimus entendveniensis* Trägardh: A. Right mandible; B. Maxillae; C. Antenna; D. Metaleg; E. Mesoleg; F. Proleg. Scale arbitrary, photos A and B were taken at 250x magnification while the rest were taken at 100x.

Abdomen inflated with large amounts of hypertrophied membrane exposed and the entire abdomen recurved permanently over the dorsal surface of the body (see Figs. 2-5). Since the sternites of most of the abdomen are now dorsal and the posterior end of the abdomen is now anterior (sometimes even anterior to the head), all further terminology will apply to the morphological orientation rather than a functional one, unless otherwise specified. Abdominal segment I membranous. Tergite II either entirely missing or fused to the anterior rim of tergite III. Tergites III-VII closely adherent with the dorsal anterior processes elongated so as to overlap and strengthen the recurved abdomen. Tergites III-VI otherwise very similar to those of a free-living aleocharine Staphylinid and bearing spiracles. Tergite VII bearing posteriorly directed processes which serve as support for the widened collar or pseudocaput in this area. These processes appear to be derived from the paratergites of segment VII. Paratergites of segment III-VI appear to be fused with the tergites and to be posteriorly developed to overlap the forward directed processes of these tergites to produce the strengthening device for the recurved abdomen. Tergite VIII with shorter forward directed processes but otherwise appears normal and without paratergites. Segment IX trivalved with long asymmetrical anterior directed processes in the male; with shorter symmetrical anterior directed processes in the female. Nearly all Aleocharinae exhibit this characteristic but it is particularly noticeable in species like these where a relatively large male genitalia has to be protruded and retracted through a relatively small abdominal segment IX. The count of the tergites is obviously an interpretation but these have to be labelled somehow, so the count was derived by starting with a relatively normal segment IX and tergite VIII and then counting backwards to the more modified segments. Because it is simpler to assume that tergite II is the missing segment than that a segment was lost in the middle of the abdomen, this interpretation was used here. The sternites are even more difficult to interpret. Fortunately enough specimens were available for study so that some could be cleared. The large sclerotized part at the curvature of the abdomen and anterior to it is here interpreted as sternite III. Sternite II is typically absent in Aleocharinae and sternite I is always absent. Sternite IV is a weakly sclerotized sternite posterior to the curve and on the functionally dorsal surface. Sternites IV-VII are represented by regularly placed sclerotized patches which are easily interpreted but whose size and shape vary by species. Sternite VIII and IX are regularly shaped. The precise shape of the membranous portions of the abdomen vary by species but in general there is an enlarged functionally posterior portion, a somewhat constricted but still enlarged portion functionally anterior to that and an extremely enlarged portion functionally anterior to that. These were given the names pseudocaput, pseudothorax, and pseudoabdomen by Trägårdh and I shall adhere to those terms here. Male genitalia is large and bulbous and has simple lateral lobes. The shape is constant throughout the genus but the size varies by species. Since there are better size indices of the species, the male genitalia will not be used to define the species. No sclerotized spermatheca present in females.

Notes: This description is different from that of Seevers (l.c.) primarily because the specimens available for study by Seevers are all herein placed in the new genus *Nasutimimus.* He did however note the difference between the mouthparts he saw and those described by Trägårdh.

Key to Species of *Termitomimus*

1. Sternites (dorsally) of the abdomen extensively sclerotized, all reddish brown in color; pseudo-thorax developed laterally into dorsally directed appendage-like lobes (Figs. 5A and 5C) 2

1′. Sternites (dorsally) of the abdomen not extensively sclerotized, yellowish brown in color; pseudo-thorax developed laterally into flat flap-like lobes which are directed mostly to the side (Figs. 2A and 3A) 3

2. Outline of pseudoabdomen at the curvature evenly rounded when viewed from the top; sternite VI entire, without an upside-down V-shaped triangle in the middle .... *T. seeversi* n.sp.

2′. Outline of the pseudoabdomen at the curvature semihexagonal when viewed from the top; sternite VI with an upside-down V-shaped triangle of weak sclerotization in the middle .... *T. pretoriusi* n.sp.

3. Lateral edges of the pseudocaput developed into long appendage-like lobes which extend past the pseudothorax (Fig. 4B) .... *T. coatoni* n.sp.

3′. Lateral edges of pseudocaput not so developed 4

4. Abdomen with longer and more numerous setae at the curvature of the abdomen (morphologically at the posterior edge of the third sternite) 5

4′. Abdomen with very few setae which do not become more numerous nor longer at the curvature of the abdomen 6

5. Membrane of the abdomen between abdominal sternites III and IV with many setae, situated on wart-like tuberosities .... *T. hettyae* n.sp.

5′. Membrane of the abdomen between abdominal sternites III and IV without setae, devoid of tuberosities .... *T. sheasbyi* n.sp.

6. Extension of abdominal sternite III plainly visible from the dorsal view about midway between sternite III and IV (Figs. 2A and 2C) 7

6′. Extensions of abdominal sternite III not plainly visible, what traces can be seen are closer to sternite IV than to the posterior edge of sternite III .... *T. entendveniensis* Träg.

7. Pseudocaput much larger than pseudothorax (Fig. 2A); 6 setae on sternite VIII .... *T. alzadae* n.sp.

7′. Pseudocaput only slightly larger than the pseudothorax; 8 setae on sternite VIII .... *T. vanderlindei* n.sp.

Termitomimus alzadae n.sp.

Figs. 2A, 2B, and 9

Most closely related to *T. vanderlindei* n.sp. from which it is distinguished having but 6 setae on abdominal sternite VIII. Also the maximum width of the pseudocaput is proportionately wider than that of *T. vanderlindei,* and the third sternite somewhat longer.

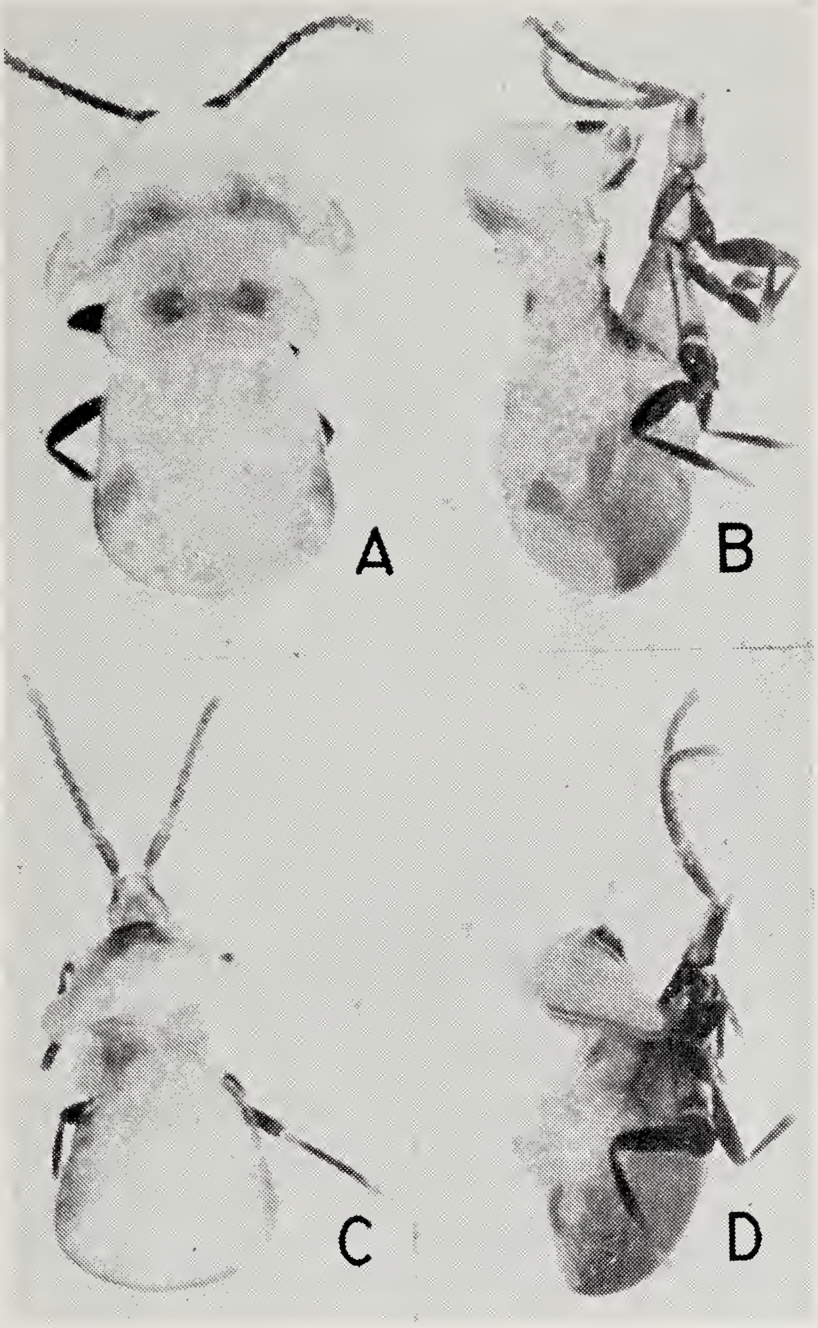

Fig. 2. *Termitomimus alzadae* n.sp.: A. Dorsal view; B. Lateral view. *T. vanderlindei* n. sp.: C. Dorsal view; D. Lateral view. Scale arbitrary, see descriptions for measurements. Dorsal and lateral views are of the same specimen taken at the same magnification and given identical enlargement.

Overall body shape (dorsal and lateral) as in Figs. 2A and 2B. Basic color of the sclerotized portions of the head, pronotum, elytra, and antennae light yellowish brown, with the dorsal portions of the pronotum a little darker but still yellowish brown. Legs blackish brown except for the tarsi which are light yellowish brown. Sternites very light yellowish brown except for sternite III which is orange-brown. Tergites somewhat darker. Basal tarsal segment of the hind leg slightly broader and very slightly shorter than the rest of the tarsus, so slightly (0.02 mm) so as to be considered approximately equal.

Membranous parts of the abdomen with a sparse covering of fine setae which are more numerous and somewhat longer at the curvature (morphologically posterior to sternite III). Abdominal sternite III with no basal median split. Secondary sclerotization is involved in the formation of sternite III, V, VI, and VII. Pseudocaput wider than the pseudothorax. Sternite VIII with 6 setae. Outline of recurved abdomen at the functionally posterior border broadly rounded and blunt.

Measurements: Head length, 0.24-0.26 mm; pronotum length, 0.25-0.26 mm; maximum length of pseudocaput, 0.62-0.67 mm; maximum length of pseudothorax, 0.22-0.25 mm; length of sternite III, 0.75-0.80 mm; maximum width of pseudothorax, 0.63-0.69 mm; maximum width of pseudocaput, 0.98-1.02 mm. Number measured, 10.

Holotype: 1, No. 12563, South-West Africa, Ovamboland, 30 mi. ex Rua Cana Falls—Eunda, (17° 15-29′ S, 14° 30-44′ E), 12 September 1966, Coll. J. L. Sheasby, ex nest below low moundlet, No. T-493. In the National Collection of Insects, Pretoria.

Paratypes: South-West Africa: 3, same data as holotype, (NCI, DK); 2, 40 mi. ex Outjo—Otjikondo, 7 April 1966, ex nest below moundlet, Coll. J. L. Sheasby, No. T-447, (NCI, DK); 1, 10 mi. ex Otavi—Tsumeb (19° 30-44′ S. 17° 15-29′ E), 5 September 1966, ex nest below low moundlet, Coll. J. L. Sheasby, No. T-487, (NCI); 8, Ovamboland, 30 mi. ex Ondangua—Ombalantu (17° 30-44′ S, 15° 30-44′ E), 9 September 1966, ex nest below low moundlet, Coll. J. L. Sheasby, No. T-491, (NCI, DK); 4, Ovamboland, 50 mi. ex Ombalantu—Oshikango (17° 15-29′ S, 15° 30-44′ E), 13 September 1966, ex nest beneath low moundlet, Coll. J. L. Sheasby, No. T-494, (NCI, DK); 3, Ovamboland, 20 mi. ex Elundu—Ondema (17° 15-29′ S, 16° 45-59′ E), 16 September 1966, ex nest beneath prone log, Coll. G. F. Pretorius, No. T-498, (NCI, DK); 1, Ovamboland, 20 mi. ex Oshikango—Ombalantu (17° 15-29′ S, 15° 30-44′ E), 22 September 1966, ex nest below moundlet, Coll. W. G. H. Coaton, No. T-501, (NCI); 2, Okavango, 40 mi. ex Kuring Kuru—Runta (17° 45-59′ S, 19° 00-14′ E), 1 October 1966, ex nest below low moundlet, Coll. J. L. Sheasby, No. T-511, (NCI, DK); 1, Eiseb Omuramba, 100 mi. ex Otjinenu—Pt. 71 (20° 30-44′ S, 20° 00-14′ E), 11 April 1967, Coll. W. G. H. Coaton, No. T-543, (NCI); 5, 10 mi. ex Tsotsana—Botswana border (18° 45-59′ S, 20° 45-59′ E), 21 April 1967, Coll. G. F. Pretorius, No. T-578, (NCI, DK); 8, 10 mi. ex Tamso—Botswana border (18° 30-44′ S, 20° 45-59′ E), 23 April 1967, Coll. J. L. Sheasby, No. T-580, (NCI, DK); 4, 50 mi. ex Runtu—Karakuwisa (18° 30-44′ S, 19° 30-44′ E), 2 May 1967, Coll. J. L. Sheasby, No. T-591, (NCI, DK); 18, 90 mi. ex Runtu—Karakuwisa (18° 45-59′ S, 19° 30-44′ E), 3 May 1967, Coll. G. F. Pretorius, No. T-596, (NCI, DK); 1, 20 mi. ex Kano Vlci—Maroelaboom (19° 15-29′ S, 19° 00-14′ E), 4 May 1967, Coll. W. G. H. Coaton, No. T-602, (NCI); 6, 10 mi. ex Farm Guchab 595—Hohensee 304 (19° 45-59′ S, 17° 45-59′ E), 7 May 1967, Coll. W. G. H. Coaton, No. T-609, (NCI, DK); 1, Waterberg Plateau on Farm Kurland 457 (20° 15-29′ S, 17° 15-29′ E), 8 May 1967, Coll. W. G. H. Coaton, No. T-611, (NCI); 6, 20 mi. ex Farm Okosongominga 149—Lapaloma 438 (20° 45-59′ S, 17° 15-29′ E), 10 May 1967, Coll. J. L. Sheasby, No. T-613, (NCI, DK).

Notes: The majority of the specimens (51/75) were taken from nests determined as *Trinervitermes rhodesiensis* (Sjoestedt). These specimens are in the National Isoptera Collection, Pretoria, under accession numbers TM20066, TM21757, TM 19900, TM19982, TM20105, TM20417, TM20780, TM21271, TM21862, TM22479, TM22285, TM22493, and TM22666. Two specimens (T-447) were taken from a nest determined as *Trinervitermes rapulum* (Sjoestedt), specimens of which are in the National Collection of Isoptera, Pretoria, under the accession number TM18725. Twenty-two specimens (T-498, T-596, and T-611) were taken from 3 nests determined as *Trinervitermes dispar* (Sjoestedt). Specimens from these nests are in the same collection under accession numbers TM20260, TM22401, and TM22621. All determinations were made by Mr. W. A. Sands. The distribution of this species is shown in fig. 9.

***Termitomimus vanderlindei* n.sp.**

Figs. 2C, 2D, and 11

Very closely related to *T. alzadae* n.sp. and difficult to distinguish from it. It can be distinguished from *T. alzadae* by the presence of 8 setae on abdominal sternite VIII, the relatively narrower pseudocaput, and the somewhat shorter abdominal sternite III.

Overall body shape (dorsal and lateral) as in figs. 2C and 2D. Basic color of the sclerotized parts of the head, pronotum, elytra, and antennae light yellowish brown. Legs blackish brown except for the tarsi which are light yellowish brown. Sternites very light yellowish brown except for sternite III which is orange brown. Tergites somewhat darker. Basal tarsal segment of hind leg slightly broader and considerably shorter (0.07 mm) than the combined length of the rest of the tarsal segments of the metaleg.

Membranous parts of the abdomen with a sparse covering of fine setae which are more numerous and somewhat longer at the curvature. Abdominal sternite III with no basal median split. Secondary sclerotization is involved in the formation of sternites III, V, VI, and VII. Pseudocaput wider than the pseudothorax. Sternite VIII with 8 setae. Outline of recurved abdomen at the functional posterior border broadly rounded and blunt.

Measurements: Head length, 0.24-0.25 mm; pronotum length, 0.23-0.25 mm; maximum length of pseudocaput, 0.30-0.32 mm; maximum length of the pseudothorax, 0.12-0.15 mm; length of sternite III, 0.65-0.67 mm; maximum width of pseudothorax, 0.55-0.57 mm; maximum width of pseudocaput, 0.55-0.58 mm. Number measured, 4.

Holotype: 1, No. 13083, Republic of South Africa, Transvaal, Letaba District, 9 mi. ex Munnik—Mokeetsi, 12 February 1964, Coll. J. L. Sheasby, No. T-300. In the National Collection of Insects, Pretoria.

Paratypes: 3, same data as the holotype, (NCI, DK).

Notes: The host colony was determined as *Trinervitermes dispar* (Sjoestedt) by Dr. W. G. H. Coaton. Specimens of the host colony are in the National Isoptera Collection under accession number TM13351. This species is named for Dr. W. J. Van der Linde, Assistant Chief of the Plant Protection Research Institute, Pretoria. The distribution of this species is shown in fig. 11.

Termitomimus entendveniensis Trägårdh

Figs. 1, 3A, 3B, and 11

Termitomimus entendveniensis Trägårdh, 1907: 174, Figs. 1-10, pl. 1, Figs. 1-18 (Republic of South Africa, Natal, Entendweni Bush, near junction of the Black and White Umfolozi Rivers, with *Eutermes* sp.); Warren, 1920: 300 (Republic of South Africa, nr. Pietermaritzburg, *Trinervitermes trinerviformis* (Holmgren)); Seevers, 1957: 154 (no new host or locality data).

Most closely related to *T. hettyae* n.sp. from which it is distinguished by its overall shape (compare figs. 3A and 3B with 3C and 3D) and also by its slightly longer pronotum, its darker pronotum, by its lack of secondary sclerotization in the region of sternite V, by its obtuse abdomen at the curvature, as well as by the presence of 6 setae on sternite VIII, and the first tarsal segment of the hind leg being slightly shorter than the rest of the tarsal segments collectively. Also related to *T. coatoni* n.sp. from which it is distinguished by all the characters before the "as well as" above in addition to the lack of long posteriorly directed lateral processes from the pseudocaput and having the pseudocaput wider than the pseudothorax.

Overall body shape (dorsal and lateral) as in figs. 3A and 3B. Basic color of sclerotized portions of the head, pronotum, elytra, and antennae light yellowish brown with the dorsal portions of the pronotum darker. Legs blackish brown except for the tarsi which are light yellowish brown. Sternites very light yellowish brown except for sternite III which is orange-brown. Tergites somewhat darker. Basal tarsal segment of the hind leg slightly broader and slightly shorter than the rest of the tarsal segments collectively.

Membranous parts of the abdomen with a sparse covering of fine setae which neither increase in frequency or length at the curvature (morphologically posterior to sternite III). Abdominal sternite III with no basal median split. Secondary sclerotization involved in the formation of sternites III, VI, and VII. Pseudocaput wider than the pseudothorax. Sternite VIII with 8 setae. Outline of recurved abdomen at the functionally posterior border broadly rounded and blunt.

Measurements: Head length, 0.25-0.26 mm; pronotum length, 0.29-0.31 mm; maximum length of pseudocaput, 0.22-0.25 mm; maximum length of pseudothorax, 0.16-0.18 mm; length of sternite III, 1.00-1.02 mm; maximum width of pseudothorax, 0.94-0.96 mm; maximum width of pseudocaput, 0.98-1.02 mm. Number measured, 10.

Material examined: Republic of South Africa: Transvaal: 29, 9 mi. ex De Langes Drift—Standerton, 10 and 11 September 1963, Coll. J. L. Sheasby, Nos. T-162 and T-163, (NCI, DK); 15, 16 mi. ex Standerton—Rooibank, 13 September 1963, Coll. J. L. Sheasby, No. T-170, (NCI, DK); 3, 13 mi. ex Pretoria—Pienaars River, 11 November 1963, Coll. J. L. Sheasby, No. T-183, (NCI, DK); 6, 28 mi. ex Pretoria—Pienaars River, 13 November 1963, Coll. J. L. Sheasby, No. T-186, (NCI, DK). Orange Free State: 4, 10 mi. ex Frankfort—Heilbron, 2 October 1963, Coll. J. L. Sheasby, No. T-210, (NCI, DK); 54, 25 mi. ex Virginia—Theunissen, 3 October 1963, Coll. J. L. Sheasby, No. T-211, (NCI, DK); 14, 20 mi. ex Bloemfontein—De Wetsdorp, 4 October 1963, Coll. J. L. Sheasby, No. T-212 and G. F. Pretorius, No. T-213, (NCI, DK).

Notes: The host colonies were all determined as *Trinervitermes trinervoides* (Sjoestedt) by Dr. W. G. H. Coaton and are located in the National Isoptera Collection, Pretoria, under accession numbers S-38, S-39, S-43, S-46, S-47, TM13111, TM13112, TM13114, and TM13116. *Trinervitermes trinerviformis* (Holmgren), the former recorded host, was placed in synonymy with *T. trinervoides* (Sjoestedt) by Sands (1965, p. 132.) The distribution of this species is shown in fig. 11.

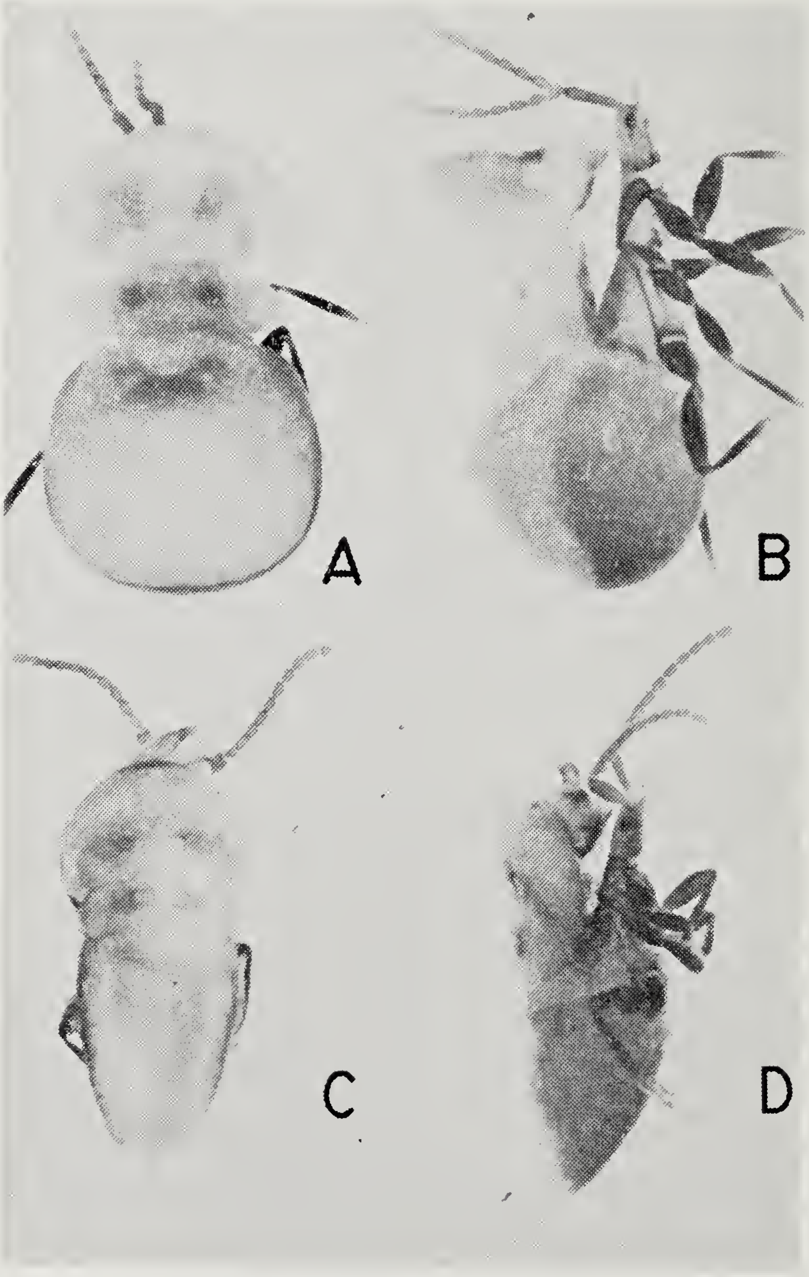

Fig. 3. *Termitomimus entendveniensis* Trägardh: A. Dorsal view; B. Lateral view. *T. hettyae* n.sp.: C. Dorsal view; D. Lateral view. Scale arbitrary, see descriptions for measurements.

***Termitomimus hettyae* n.sp.**

Figs. 3C, 3D, and 11

Most closely related to *T. alzadae* n.sp. and *T. vanderlindei* n.sp. from which it is easily distinguished by the unique shape as well as by the wart-like protuberances from the membrane between sternites III and IV. Also related to *T. entend-*

veniensis Trägårdh from which it is distinguished by the same characteristics. This is a highly distinctive species known from 3 colonies from Cape Province.

Overall body shape (dorsal and lateral) as in figs. 3C and 3D. Basic color of the sclerotized portions of the head, pronotum, elytra, and antennae light yellowish brown; dorsal portions of the pronotum not noticeably darker than the rest of the body. Legs dark brown except for the tarsi which are light yellowish brown. Sternites a little darker than the sternites. Basal segment of hind tarsus slightly broader and of approximately equal length to the rest of the tarsal segments collectively.

Membranous parts of abdomen with a sparse covering of inconspicuous fine yellow setae which are neither more numerous nor longer at the curvature. Membrane between sternites III and IV with many wart-like protuberances (fig. 3C). Abdominal sternite III with a median anterior V-shaped notch but with no basic split. Secondary sclerotization is involved in the formation of sternites III, V, VI, and VII. Pseudocaput wider than the pseudothorax. Sternite VIII with 8 setae. Outline of recurved abdomen at the functionally posterior border pointed.

Measurements: Head length, 0.25-0.26 mm; pronotum length, 0.25-0.26 mm; maximum length of the pseudocaput, 0.70-0.71 mm; maximum length of the pseudothorax, 0.33-0.34 mm; length of sternite III, 1.04-1.05 mm; maximum width of pseudothorax, 0.82-0.83 mm; maximum width of the pseudocaput, 1.09-1.10 mm. Number measured, 3.

Holotype: 1, No. 12562, Republic of South Africa, Cape Province, at Murraysburg, 12 October 1963, Coll. J. L. Sheasby, No. T-216. In the National Collection of Insects, Pretoria.

Paratypes: Republic of South Africa, Cape Province: 1, 7 mi. ex Loeriesfontein–Brandvlei, 18 October 1963, Coll. J. L. Sheasby, No. T-217, (NCI); 1, 35 mi. ex De Aar–Philipstown, 23 October 1963, Coll. J. L. Sheasby, No. T-218, (DK).

Notes: The host colonies were all determined as *Trinervitermes trinervoides* (Sjoestedt) by Dr. W. G. H. Coaton. Specimens of the hosts are in the National Isoptera Collection under accession numbers TM13120, TM13123, and TM13125. The distribution of this species is shown in fig. 11.

The ladies who are directly or indirectly involved in the collection of insects are all too often neglected. Our wives have to put up with a lot from all of us who spend time in the field. If they stay home, they must view our trips over the veld in search of termites and termitophiles as lengthy escapes from familial responsibilities. The fact that we revel in the work and reminisce about wonderful sunsets in Zululand over sundowners does little to change their opinions. On the other hand if they go with us they face 15 months of living out of a suitcase, making camp in alien surroundings, a dearth of beauty shops which may last months on end, to say nothing of minor inconveniences such as mosquitoes laden with malarial parasites, etc. It is a wonder that the marriages of most entomologists are as stable as they are. To honor all such ladies and 2 in particular, I am naming this species after Hetty Coaton, the wife of Dr. W. G. H. Coaton, and *T. alzadae* was named for my wife, Alzada Carlisle Kistner.

Termitomimus coatoni n.sp.

Figs. 4A; 4B, and 9

This is a highly distinctive species because of the elongation of the latero-ventral edges of the pseudocaput into long membranous appendages. This is not the same sort of abdominal appendage found in *Spirachthodes* Seevers or *Coatonachthodes* Kistner because it lacks a sclerotized insertion socket and is simply a part of the pseudocaput which has become elongated. It is most closely related to *T. vanderlindei* n.sp. and *T. alzadae* n.sp. from which it is distinguished by its abdomen being pointed at the curvature as well as the long projections of the pseudocaput.

Overall body shape (dorsal and lateral) as in figs. 4A and 4B. Basic color of the sclerotized portions of the head, pronotum, elytra, and antennae light yellowish brown with the dorsal portions of the pronotum a little darker but still yellowish brown. Legs blackish brown except for the tarsi which are light yellowish brown. Sternites yellowish brown except for sternite III which is orange-brown. Tergites darker brown in color. Basal tarsal segment of the hind leg slightly broader but much shorter than the rest of the tarsal segments collectively.

Membranous parts of the abdomen with a fine covering of inconspicuous setae which are more numerous and longer at the abdominal curvature (morphologically posterior to sternite III). Abdominal sternite III with no basal median split. Secondary sclerotization is involved in the formation of sternites III, V, VI, and VII. Pseudocaput narrower than the pseudothorax. Sternite VIII with 6 setae. Outline of recurved abdomen at the functionally posterior border pointed.

Measurements: Head length, 0.25 mm; pronotum length, 0.24 mm; maximum length of the pseudocaput, 0.60 mm without the appendage, 1.27 mm with it; maximum length of the pseudothorax, 0.20 mm; length of sternite III, 0.97 mm; maximum width of pseudothorax, 0.95 mm; maximum width of pseudocaput, 0.75 mm. Number measured, 1.

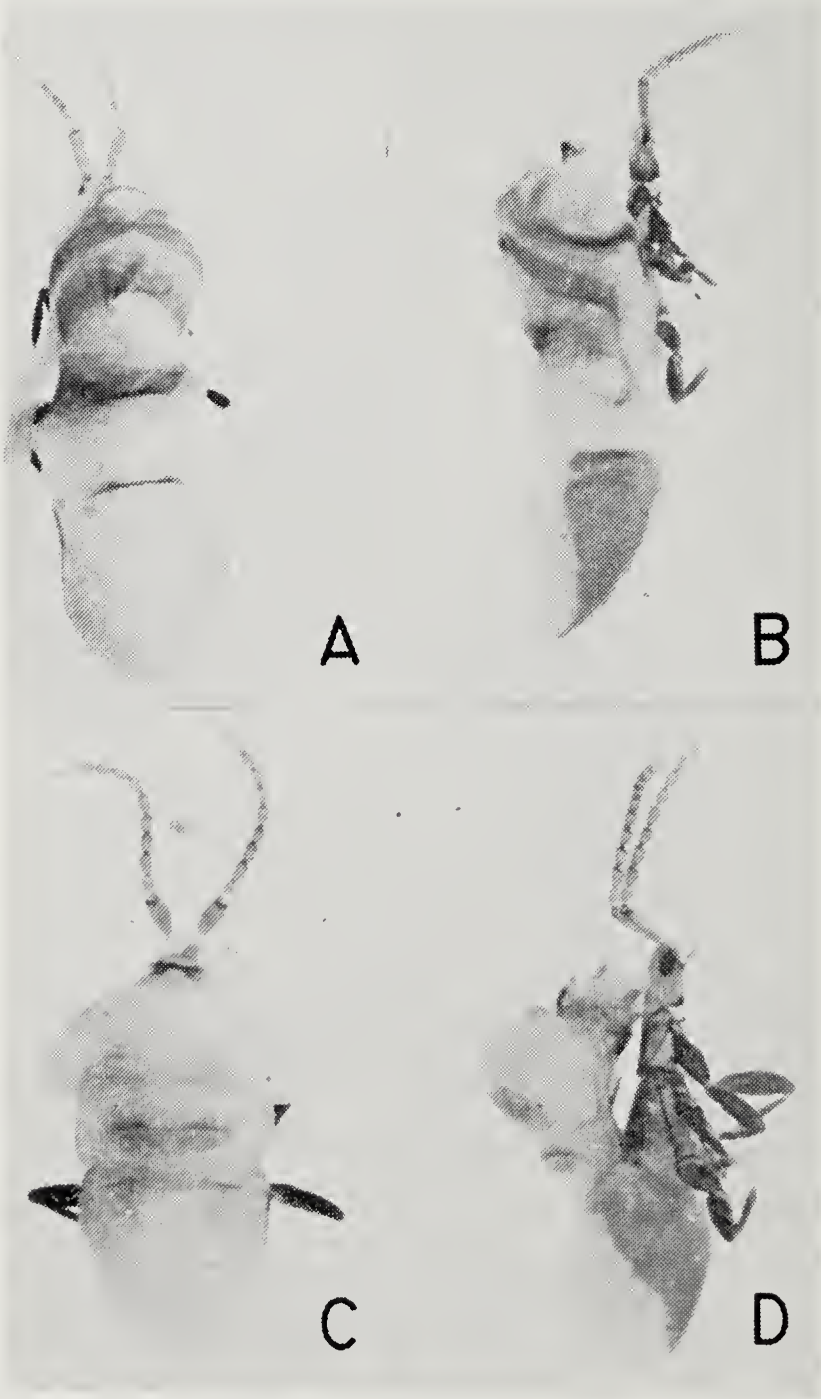

Fig. 4. *Termitomimus coatoni* n.sp.: A. Dorsal view; B. Lateral view. *T. sheasbyi* n.sp.: C. Dorsal view; D. Lateral view. Scale arbitrary, see descriptions for measurements.

Holotype: 1, No. 12560, South-West Africa, 10 mi. ex Kalkfeld–Omaruru, 24 September 1965, Coll. J. L. Sheasby, No. T-434.

Notes: The host colony of this species was determined as *Trinervitermes dispar* (Sjoestedt) by Mr. W. A. Sands. The host specimens are in the National Isoptera Collection, Pretoria, under accession No. TM18119. This species is named for Dr. W. G. H. Coaton whose interest in the termitophiles has led to the intensive collecting effort which has more than doubled the known species from the continent of Africa. The distribution of this species is shown in fig. 9.

Termitomimus sheasbyi n.sp.

Figs. 4C, 4D, and 11

A highly distinctive species which is most closely related to *T. hettyae* but is distinguished from it by its overall shape, the lack of wart-like projections from the membrane between abdominal sternites III and IV and the lack of secondary sclerotization of abdominal sternite VII, in fact there is little secondary sclerotization involved in any sternites except the third.

Overall body shape (dorsal and lateral) as in figs. 4C and 4D. Basic color of the sclerotized parts of the head, pronotum, elytra, and antennae light yellowish brown, dorsal parts of pronotum no darker than the head except at the very edges. Legs blackish brown except for the tarsi which are light yellowish brown. Sternites very light yellowish brown except for sternite III which is orange brown. Tergites somewhat darker. Basal segment of the hind tarsus slightly broader and as long as the rest of the tarsus.

Membranous parts of the abdomen with an extensive covering of fine yellow setae which become longer and more numerous at the curvature. Abdominal sternite III with no basal median split. Secondary sclerotization is not involved in the formation of any abdominal sternites except III. Pseudocaput wider than the pseudothorax. Sternite VIII with 6 setae. Outline of recurved abdomen at the functional posterior border pointed.

Measurements: Head length, 0.26-0.27 mm; pronotum length, 0.25-0.26 mm; maximum length of the pseudocaput, 0.58-0.60 mm; maximum length of the pseudothorax, 0.24-0.27 mm; length of sternite III, 0.86-0.87 mm; maximum width of the pseudothorax, 0.86-0.87 mm; maximum width of the pseudocaput, 1.14-1.16 mm. Number measured, 4.

Holotype: 1, No. 12559 Republic of South Africa, Cape Province, 35 mi. ex Poffadder–Springbok, 20 June 1963, Coll. J. L. Sheasby, No. T-71. In the National Collection of Insects, Pretoria.

Paratypes: Republic of South Africa, Cape Province: 1, 22 mi. ex Prieska–Van Wyksvlei, 11 October 1961, Coll. J. L. Sheasby, No. TM9139, (NCI); 2, 30 mi. ex Brandvlei–Williston, 18 October 1963, Coll. J. L. Sheasby, No. T-220, (NCI, DK).

Notes: The host colonies were all determined as *Baucaliotermes hainesi* (Fuller) by Dr. W. G. H. Coaton. Specimens of the hosts are in the National Isoptera Collection, Pretoria, under accession numbers TM11597, TM9139, and TM13129. This species is named for Mr. J. L. Sheasby whose termitophile collections from South and South-West Africa are without parallel. The distribution of this species is shown in fig. 11.

Termitomimus pretoriusi n.sp.

Figs. 5A, 5B, and 10

One of the handsomest species of *Termitomimus;* also highly distinctive. It is only likely to be confused with *T. seeversi* n.sp. to which it is most closely related. The easiest character to distinguish them is the shape of the lateral edge of the pseudocaput which is triangular and ventrally directed in *T. pretoriusi* and tubular and dorsally directed in *T. seeversi. T. seeversi* is much more extensively sclerotized than *T. pretoriusi* and the pseudoabdomens and pseudothoraxes have different shapes and proportions (compare figs. 5A and 5C).

Overall body shape (dorsal and lateral) as in figs. 5A and 5B. Basic color of the head, pronotum, elytra, and antennae yellowish brown with the dorsal parts of the pronotum somewhat darker. Legs blackish brown except for the tarsi which are light yellowish brown. Sternites all orange-brown, sternite III somewhat brighter orange-brown than the rest. Tergites somewhat darker. Basal tarsal segment of the hind leg slightly broader and very slightly shorter than the rest of the tarsus.

Membranous parts of the abdomen with a sparse covering of fine yellow inconspicuous setae which do not increase in frequency or length at the curvature. Abdominal sternite III with a median ventral anterior V-shaped split. Secondary sclerotization is involved in the formation of sternites III, IV, V, VI, and VII. Pseudocaput somewhat variable in width but always slightly wider than the pseudothorax. Lateral edges of the pseudocaput triangular in shape and directed postero-ventrally. Lateral edges of the pseudothorax modified into upward directed lobe-like processes. Sternite VIII with 6 setae. Outline of recurved abdomen at the functionally posterior border blunt but somewhat pointed.

Measurements: Head length, 0.24-0.26 mm; pronotum length, 0.24-0.25 mm; maximum length of pseudocaput, 0.70-1.15 mm; maximum length of the pseudothorax, 0.20-0.21 mm; length of sternite III, 1.40-1.45 mm; maximum width of the pseudocaput, 1.25-1.46 mm. Number measured, 10.

Holotype: 1, No. 12561, South-West Africa, 60 mi. ex Neudamm College–Steinhausen, 2 October 1965, Coll. W. G. H. Coaton, No. T-436. In the National Collection of Insects, Pretoria.

Paratypes: South-West Africa: 1, Neudamm College near Windhoek, 16 September 1962, Coll. W. G. H. Coaton, No. TM10772, (NCI); 1, 20 mi. ex Kalkfeld–Omaruru, 24 September 1965, Coll. G. F. Pretorius, No. T-435, (NCI); 10, 40 mi. ex Outjo–Otjikondo, 7 April 1966, ex nest below moundlet, Coll. J. L. Sheasby, No. T-447, (NCI, DK); 2, 40 mi. ex Otjiwarongo–Otavi (19° 45-59′ S, 17° 00-14′ E), 5 September 1966, ex nest below slight moundlet, Coll. J. L. Sheasby, No. T-483, (NCI, DK); 2, 10 mi. ex Otavi–Tsumeb (19° 30-44′ S, 17° 15-29′ E), 5 September 1966, Coll. J. L. Sheasby, No. T-487, (NCI, DK); 1, Ovamboland, 30 mi. ex Ondangua–Ombalantu (17° 30-44′ S, 15° 30-44′ E), 9 September 1966, Coll. J. L. Sheasby, No. T-491, (NCI); 1, Ovamboland, 50 mi. ex Ombalantu–Ombombo Ovambo (17° 45-59′ S, 14° 15-29′ E), 10 September 1966, Coll. W. G. H. Coaton, No. T-492, (NCI); 13, Ovamboland, 30 mi. ex Rua Cana Falls–Eunda (17° 15-29′ S, 14° 30-44′ E), 12 September 1966, Coll. J. L. Sheasby, No. T-493, (NCI, DK); 1, Eiseb Omuramba, 70 mi. ex Otjinenu–Point 71 (20° 30-44′ S, 19° 30-44′ E), 10 April 1967, Coll. W. G. H. Coaton, No. T-536, (NCI); 1, same locality, 10 April 1967, Coll. J. L. Sheasby, No. T-537, (NCI); 1, 30 mi. E. of Tsumkwe on tract to Botswana border (19° 30-44′ S, 20° 45-59′ E), 15 April 1967, Coll. W. G. H. Coaton, No. T-554, (NCI); 6, same locality and date, Coll. J. L. Sheasby, No. T-555, (NCI, DK); 1, same locality and date, Coll. G. F. Pretorius, No. T-557, (NCI); 2, 10 mi. ex Tsotsana–Botswana border (18° 45-59′ S, 20° 45-59′ E), 21 April 1967, Coll. J. L. Sheasby, No. T-576, (NCI, DK); 1, 50 mi. ex Runtu–Karakuwisa (18° 30-44′ S, 19° 30-44′ E), 2 May 1967, Coll. J. L. Sheasby, No. T-590, (NCI); 1, 20 mi. ex farm Okosongomingo 149–Lapaloma 438 (20° 45-59′ S, 17° 15-29′ E), 10 May 1967, Coll. J. L. Sheasby, No. T-614, (NCI).

Notes: Most of the specimens are from colonies determined as *Trinervitermes rhodesiensis* (Sjoestedt). Specimens of these host colonies are in the National Isoptera Collection, Pretoria, under accession numbers TM18390, TM10772, TM18119, TM19900, TM19982, TM20038, TM20066, TM21233, TM21237, TM21451, TM21458, TM21464, TM21751, TM22285, and TM22606. A few specimens (10–T-447) were taken from a colony determined as *Trinervitermes rapulum* (Sjoestedt.) Specimens of this colony are in the same collection under accession number TM18725. Finally 2 specimens (T-483) were taken from a colony determined as *Trinervitermes dispar* (Sjoestedt), specimens of which are in the same collection under accession number TM19871. All determinations were made by Mr. W. A. Sands. This species is named for Mr. G. F. Pretorius who collected part of the type series. The distribution of this species is shown in fig. 10.

Termitomimus seeversi **n.sp.**

Figs. 5C, 5D, and 10

Most closely related to *T. pretoriusi* n.sp. from which it is most easily distinguished by the shape of the lateral edge of the pseudocaput which is produced into a posterior and dorsally directed lobe. It is also more sclerotized (compare figs. 5A and 5C) and the border of the pseudoabdomen is more evenly rounded.

Overall body shape (dorsal and lateral) as in figs. 5C and 5D. Basic color of the sclerotized parts of the head, pronotum, elytra, and antennae yellowish brown with the dorsal parts of the pronotum dark brown. Legs blackish brown except for the tarsi which are light yellowish brown. Sternites all orange brown with the 3rd sternite just a trifle brighter. Tergites somewhat darker. Basal segment of the hind tarsus somewhat stouter and significantly shorter (0.06 mm) than the rest of the tarsal segments collectively.

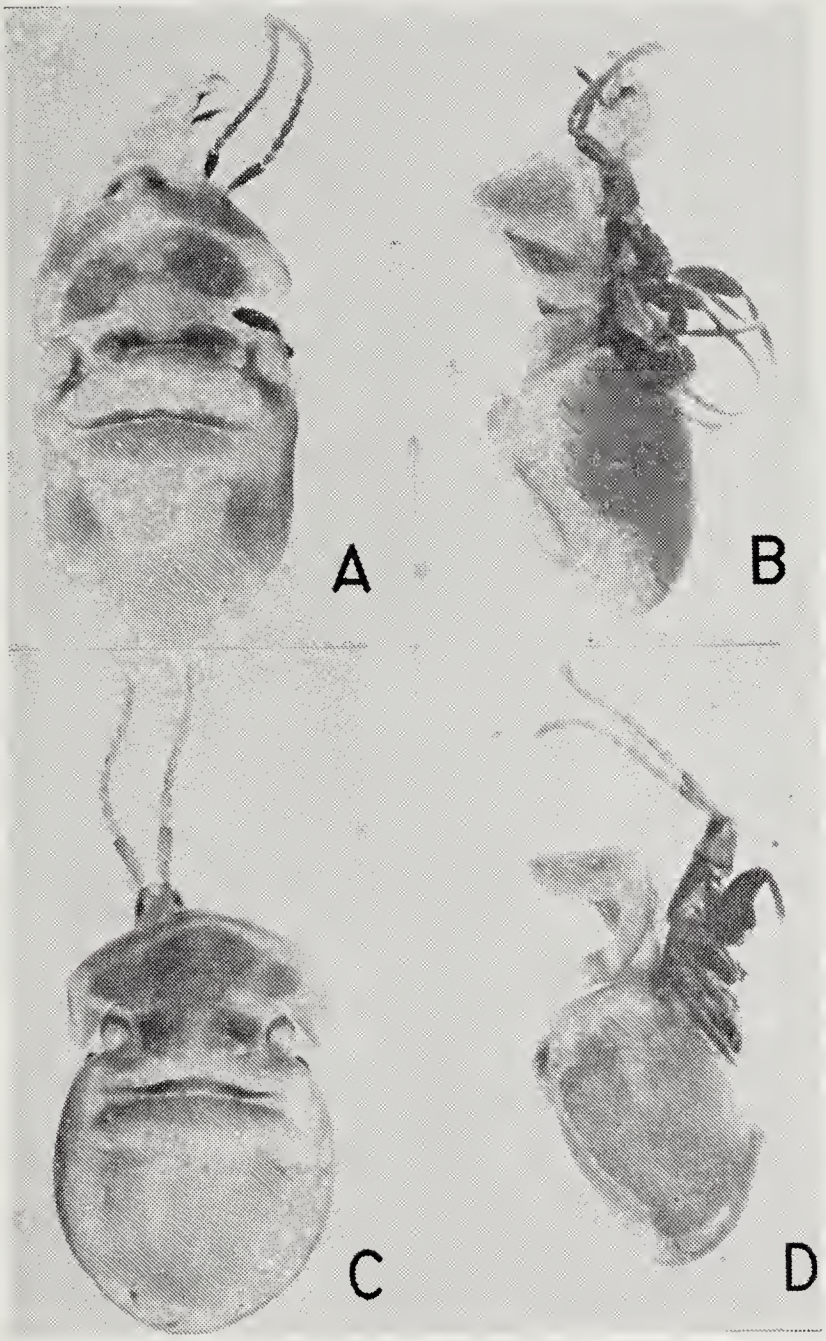

Fig. 5. *Termitomimus pretoriusi* n.sp.: A. Dorsal view; B. Lateral view. *T. seeversi* n.sp.: C. Dorsal view; D. Lateral view. Scale arbitrary, see descriptions for measurements.

Membranous parts of the abdomen with very few inconspicuous short yellow setae which are neither more numerous or longer at the curvature. Abdominal sternite III with a median ventral anterior V-shaped split. Secondary sclerotization is extensive and involved in the formation of sternites III, IV, V, VI, and VII. The shapes of these sclerites may be seen in fig. 5C and compared with those of *T. pretoriusi* n.sp. in fig. 5A. Pseudocaput significantly wider than the pseudothorax. Lateral edges of the pseudocaput produced into a lobe-like structure which is directed posteriorly and dorsally. Lateral edges of the pseudothorax also produced into lobe-like processes which are directed dorsally. Sternite VIII with 8 setae. Outline of the recurved abdomen at the functionally posterior border evenly rounded.

Measurements: Head length, 0.24-0.25 mm; pronotum length, 0.30-0.35 mm; maximum length of pseudocaput, 0.65-0.85 mm; maximum length of pseudothorax, 0.16-0.17 mm; length of sternite III, 1.20-1.27 mm; maximum width of pseudothorax, 0.96-0.98 mm; maximum width of pseudocaput, 1.27-1.41 mm. Number measured, 9.

Holotype: 1, No. 13082, South-West Africa, 45 mi. ex Nakop—Karrasburg, 3 September 1964, Coll. W. G. H. Coaton, No. T-359. In the National Collection of Insects, Pretoria.

Paratypes: South-West Africa: 1, same data as the holotype, (DK); 1, 55 mi. ex Nakop—Karrasburg, 3 September 1964, Coll. G. F. Pretorius, No. T-360, (NCI); 3, 20 mi. ex Onseepkans—Warmbad, 5 September 1964, Coll. W. G. H. Coaton and J. L. Sheasby, Nos. T-361, T-362, and T-363, (NCI, DK); 2, 40 mi. ex Goodhouse—Karrasburg, 6 September 1964, Coll. W. G. H. Coaton and G. F. Pretorius, Nos. T-365 and T-366, (NCI, DK); 1, 40 mi. ex Kalkrand—Maltahöhe, 5 October 1964, Coll. J. L. Sheasby, No. T-371, (NCI).

Notes: The host colonies of all of the specimens were determined as *Baucaliotermes hainesi* (Fuller) by Dr. W. G. H. Coaton. Specimens of the hosts are in the National Isoptera Collection under accession numbers TM14331, TM14341, TM14394, TM14395, TM14396, TM14439, TM14442, and TM15156. This species is named for my late friend and colleague, Professor Charles H. Seevers, Roosevelt University, Chicago. The distribution of this species is shown in fig. 10.

Genus *Nasutimimus* n. gen.

Termitomimus Seevers, 1957: 153 (in part); Pasteels, 1967, 59.

Distinguished from all other genera, at least in its physogastric state, by its distinctive abdomen. Most closely related to *Termitomimus* Trägårdh from which it is easily distinguished by the narrowness of abdominal sternite III which is entirely dorsal in position, by the labial palpi which are 3-segmented, and by the lack of a hyaline triangle at the posterior border of the head.

Overall body shape as in figs. 6 and 7. Head narrower in front than behind, slightly longer than broad, without a median posterior hyaline triangle. Eyes present, both forward and laterally directed. Antennae inserted between the eyes. Gula narrow anteriorly becoming somewhat wider at the base. Mentum-submentum fused, rectangular in shape. Clypeus very short. All mouthparts except for the maxillae are extremely small; the maxillae are only somewhat reduced. Labrum extremely small, reduced to a very thin dorsal flap. Mandibles reduced and shaped as shown for *Termitomimus* (fig. 1A) with no median teeth. Maxillae shaped as in *Termitomimus* (fig. 1B), palpi 4-segmented but with the 4th segment reduced to where it looks like a seta. Labium small, palpi 3-segmented. Antennae 11-segmented, somewhat shorter and more compact than in *Termitomimus*, shaped as in fig. 7B, with 2 coeloconic sensillae on the apical segment.

Pronotum subquadrate, slightly wider than the head, slightly longer than wide, with a median hyaline triangle at the anterior edge, not physogastric. The base of the triangle is at the anterior border and the apex in the midline of the pronotum slightly anterior of the center. Prosternum small, with an evenly rounded ventral median bulge. Mesothoracic peritremes appear straplike because of a pigmented stripe but are actually rather large sclerites which close the procoxal cavities behind and connect laterally to the rest of the thorax. Meso- and metasterna with a sharp line of demarkation between the mesothoracic legs. Mesosternal intercoxal process wide, blunt and acarinate. Meso- and metacoxae widely set apart. Elytra normal, without distinction. Wing stubs show evidence of having been torn off. Legs shaped as in *Termitomimus* but with darker pigmentation and what appears to be more massive sclerotization. Tarsal shape varies by species. Tarsal formula 4-4-4.

Abdomen description applies to the physogastric phase. Abdomen inflated with large amounts of hypertrophied membrane exposed and the entire abdomen recurved permanently over the dorsal surface of the body (figs. 7A and 7B). All further terminology will apply to the morphological rather than the functional orientation, unless otherwise specified. Abdominal segment I membranous. Tergite II modified into a thin plate with long processes extending posteriorly to help support the massive recurved abdomen. Tergites III-VI closely adherent with the dorsal anterior processes elongated so as to overlap and strengthen the abdomen. Tergite VII, VIII, and IX normal in shape with no very large processes. The paratergites of segments III-VII appear to be fused with the tergites and to be posteriorly developed to overlap the forward directed processes of the tergites. Segment IX trivalved with long asymmetrical anteriorly directed processes in the males and short symmetrical processes in the females. Sternites III-VI relatively normal in shape except for the long strap-like lateral processes which extend laterally about halfway to the tergites. Sternite VII reduced in width but with strap-like processes which extend laterally from the "front" of the pseudocaput. Sternite VIII normal in shape. The precise shape of the abdomen varies by species as well as the precise shape of the sternites but in general there are 3 distinct areas from the morphological posterior to anterior marked by constrictions between abdominal segments V and VI and IV and V which will be called the pseudocaput, pseudothorax, and pseudoabdomen following the tradition of Trägårdh. Male genitalia are relatively large and bulbous and have simple lateral lobes; in general they are not very useful for species discrimination. No sclerotized spermatheca present in females.

Type of the genus: Nasutimimus emersoni (Seevers)

Key to Species of *Nasutimimus*

1. Inflated abdomen with pouches developed laterally from segment IV .... *N. emersoni* (Seevers)
1′. Inflated abdomen without such pouches........................ *N. latipes* (Seevers)

Nasutimimus emersoni (Seevers) n. comb.

Termitomimus emersoni Seevers 1957: 154, figs. 24a-24c-Field Museum of Natural History, Chicago, (Congo Republic, Kivu Prov., Rwindi Camp, 5 May 1948, Coll. A. E. Emerson, with *Nasutitermes usambarensis* Sjoestedt).

Most closely related to *N. latipes* (Seevers) but distinguished therefrom by the overall appearance, the presence of a pair of lateral pouches from the membrane of abdominal segment IV, its shorter abdomen from the metasternum to the curvature, and by the individual shapes of the abdominal sternites (compare figs. 6A and 6B).

Overall body shape (dorsal and lateral) as in figs. 6A and 7A. Basic color of the sclerotized parts of the head, pronotum, elytra, and antennae yellowish brown, with the dorsal portions of the pronotum no darker than the head. Legs blackish brown except for the medial and apical parts of the coxae and segments 2, 3, and 4 of the tarsi which are light yellowish brown. All abdominal sternites light yellowish brown. Tergites yellowish brown, support processes of tergite II dark black. Basal tarsal segment of hind leg enlarged in width and more heavily sclerotized than the rest; approximately twice as wide as tarsal segment 2; equal in length to the other 3 tarsal segments collectively.

Membranous parts of the abdomen with an extensive covering of fine yellow inconspicuous setae which become denser and longer at the curvature (morphologically anterior to sternite III). Membrane with many of the setae on wart-like projections. Secondary sclerotization is involved in the formation of sternites V and VI. Pseudocaput approximately the same width as the pseudothorax. Sternite VIII with 0 setae. Outline of recurved abdomen at the functionally posterior border rounded. Segment IV with lateral outpouches.

Measurements: Head length, 0.25-0.26 mm; pronotum length, 0.26-0.27 mm; maximum length of pseudocaput, 0.60-0.62 mm; maximum length of the pseudothorax, 0.12-0.16 mm; maximum length of the outpocketing of segment IV, 0.35-0.36 mm; length of abdomen from metasternum to the curvature, 1.62-1.66 mm; maximum width of the pseudothorax, 0.87-0.89 mm; maximum width of the pseudocaput, 0.86-0.88 mm; maximum width of segment IV, 1.13-1.16 mm. Number measured, 5.

Material examined: The entire type series, (FMNH, BMNH, DK).

Notes: The host was orginally determined as *Nasutitermes usambarensis* (Sjoestedt) by Dr. A. E. Emerson. In the most recent revision of the Ethiopian Nasutitermitinae, this species was listed by Sands (1965, p. 37) as a synonym of *Nasutitermes infuscatus* (Sjoestedt) and the Rwindi Camp specimens are listed among the material examined. The distribution of this species is shown in fig. 12.

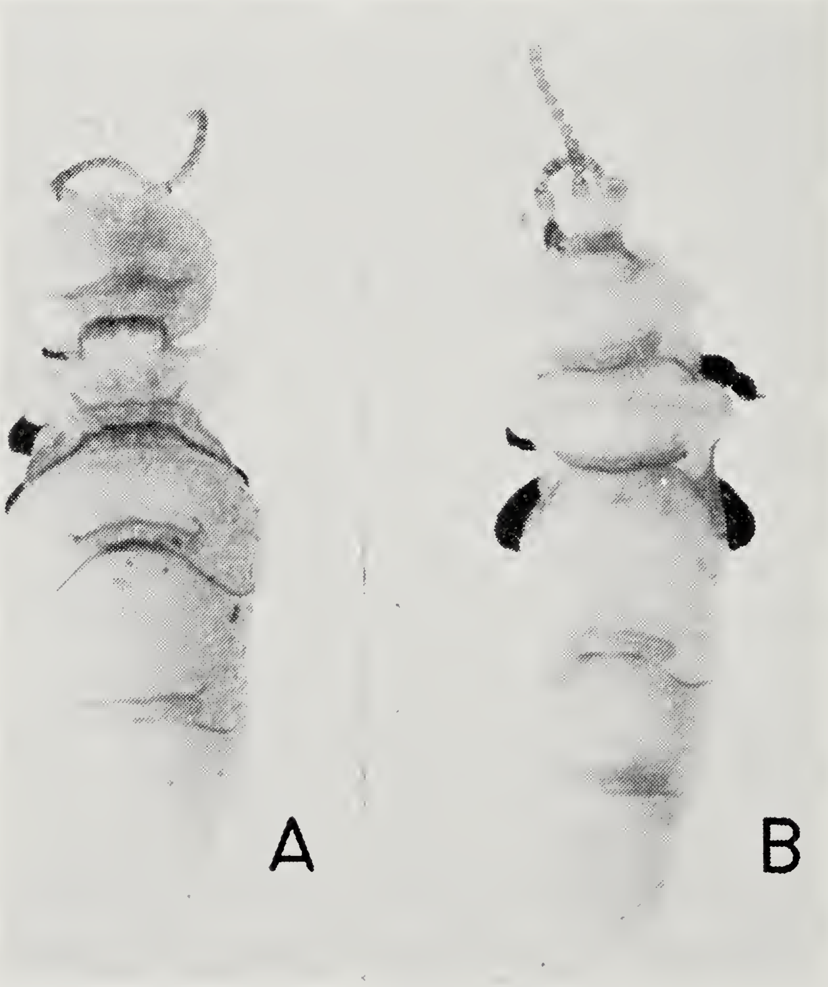

Fig. 6. Dorsal views: A. *Nasutiminus emersoni* (Seevers): B. *N. latipes* (Seevers). Scale arbitrary, see descriptions for measurements.

Nasutimimus latipes **(Seevers) n. comb.**

Figs. 6B, 7B, and 12

Termitomimus latipes Seevers 1957: 154-Field Museum of Natural History, Chicago, [Congo Republic, Stanleyville, 1 June 1948, Coll. A. E. Emerson, with *Nasutitermes maculiventris* (Sjoestedt)].

Most closely related to *N. emersoni* (Seevers) but distinguished therefrom by its overall appearance, the absence of lateral pouches from the membrane of abdominal segment IV, its longer abdomen from the metasternum to the curvature, and by the individual shapes of the abdominal sternites (compare figs. 6B to 6A).

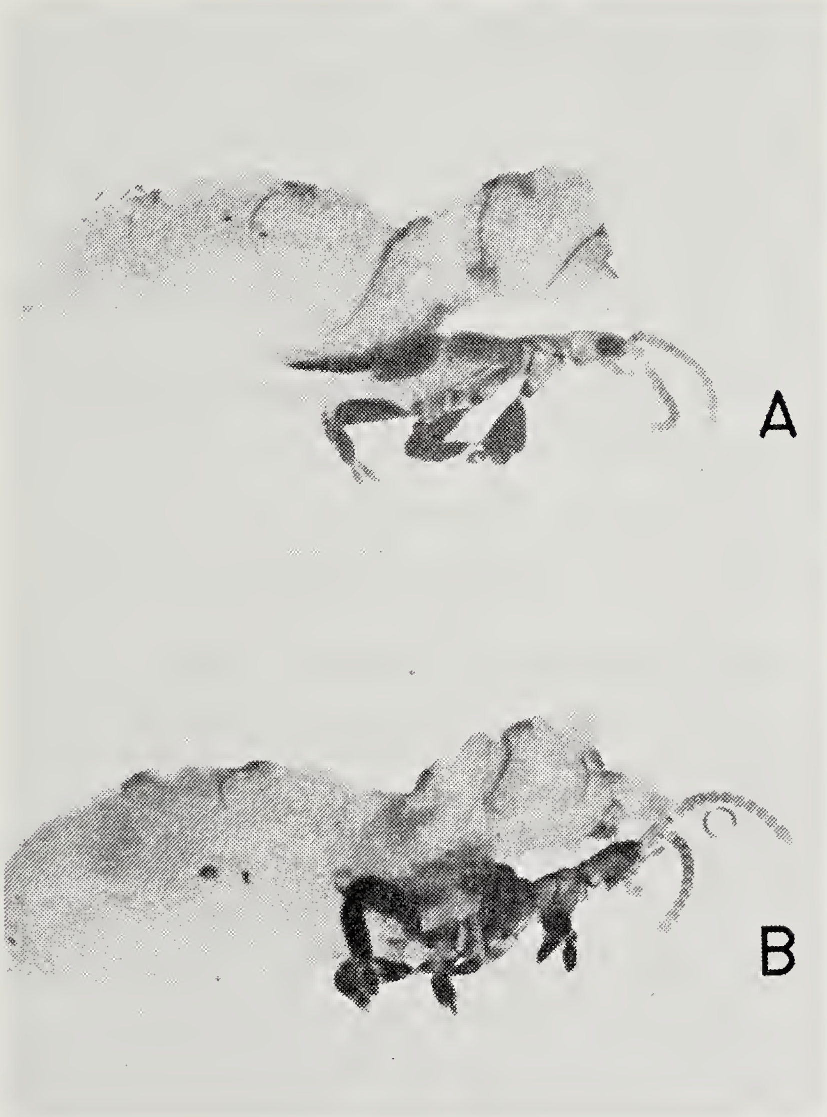

Fig. 7. Lateral views: A. *Nasutimimus emersoni* (Seevers): B. *N. latipes* (Seevers). Scale arbitrary, see descriptions for measurements.

Overall body shape (dorsal and lateral) as in figs. 6B and 7B. Basic color of the sclerotized parts of the head, pronotum, elytra, and antennae yellowish brown, with the dorsal portions of the pronotum no darker than the head. Legs blackish brown except for the medial and apical parts of the coxae and segments 2, 3, and 4 of the tarsi which are light yellowish brown. All abdominal sternites light yellowish brown. Tergites basically also yellowish; support processes of tergite II not particularly black, but somewhat darker. Basal tarsal segment of hind leg enlarged in width and more heavily sclerotized than the rest; approximately 2½-3 times the width of segment 2; slightly longer (0.02 mm) than the other 3 tarsal segments collectively.

Membranous parts of the abdomen with a sparse covering of fine yellow inconspicuous setae which become denser and longer at the curvature. Membrane with some setae on wart-like projections which are limited to the ventral and curvature areas of the abdomen. Secondary sclerotization is involved only in the formation of sternite V. Pseudocaput narrower than the pseudothorax. Sternite VIII with 6 setae. Outline of recurved abdomen at the functionally posterior border rounded. Segment IV with no lateral outpouches.

Measurements: Head length, 0.25-0.26 mm; pronotum length, 0.30-0.31 mm; maximum length of the pseudocaput, 0.17-0.19 mm; maximum length of the pseudothorax, 0.16-0.19 mm; length of the abdomen from the metasternum to the curvature, 1.87-1.94 mm; maximum width of the pseudothorax, 0.91-0.94 mm; maximum width of the pseudocaput, 0.80-0.84 mm. Number measured, 4.

Material examined: The type series, (FMNH, DK).

Notes: The host was originally determined as *Nasutitermes maculiventris* (Sjoestedt) by Dr. A. E. Emerson. In a recent paper Sands (1965, p. 20) made this name a synonym of *Nasutitermes arborum* (Smeathman) and included Stanleyville (now called Kisangani, which used to be the name of one of the native towns near Stanleyville) specimens collected by Emerson in the material examined section. However specimens bearing the date of capture of these termitophiles were not included. Since no specimens bearing this date of capture are listed under any other species of *Nasutitermes* in the same paper, it is highly probable that *N. arborum* is now the correct host name. The distribution of the species is shown in fig. 12.

Relationships of the Species and Host Specificity

Aside from being able to state that *Nasutimimus* is a more primitive genus than *Termitomimus* because of less extensive modification of sclerotized parts and because of more primitive mouthparts, the traditional methods do not permit a formal statement of any other relationships. For this reason numerical methods were used to see what patterns of relationships might emerge. A list of unit characters was developed following the general procedures of Sokal and Sneath (1963). The characters were then coded 0 for absence and 1 for presence. Our programs use the code 3 for no comparisons but for this list of characters there were none of these. The following is the list of characters chosen:

1. Abdominal sternite III located ventrally and extensively sclerotized.
2. Pronotum length 0.30 mm or longer.
3. Pronotum blackish brown.
4. Head with a median posterior hyaline area on the dorsal surface.
5. Width of the basal segment of the hind coxae 2 or more times the width of the 2nd segment.
6. Abdominal tergites IV-VII yellowish brown.
7. Abdominal sternites IV-VIII yellowish brown.
8. Extensive yellow setae on abdominal membranous areas.
9. Basal tarsal segment of hind leg approximately equal to the rest of the tarsal segments in length (less the 0.03 mm difference).

10. Secondary sclerotization involved in sternite IV.
11. Secondary sclerotization involved in sternite V.
12. Secondary sclerotization involved in sternite VI.
13. Secondary sclerotization involved in sternite VII.
14. Abdominal segment IV with lateral outpouchings.
15. Length of the abdominal sternite III or area between the metasternum and the abdominal curvature divided by the maximum width of the pseudocaput is greater than 1.0. This is an indicator of elongation.
16. Dorsal outline of the abdominal curvature pointed.
17. Maximum width of the pseudocaput equal to the maximum width of the pseudothorax (difference is less than 0.02 mm).
18. Basal segment of hind tarsus black.
19. Pseudocaput with posteriorly directed lateral extensions.
20. Setae at the abdominal curvature longer than setae elsewhere on the abdomen.
21. Pseudothorax appendage-like.
22. Basal part of coxae yellowish brown.
23. 6 setae on sternite VIII.
24. 0 setae on sternite VIII.
25. Basal segment of hind tarsus shorter than the rest of the tarsus.
26. Maximum width of the pseudocaput greater than the maximum width of the pseudothorax.
27. Lateral projections of the pseudocaput appendage-like and dorsally directed.
28. Maximum length of the pseudocaput greater than that of the pseudothorax.
29. Physothorax.
30. Maximum length of the pseudocaput more than 4 times the length of the pseudothorax.
31. Abdominal sternite III with a median ventral anterior V-shaped split.

TABLE 1.

Distribution of unit characters in *Termitomimus* and *Nasutimimus* species. Characters are arranged sequentially from left to right.

Species No.	*Species*	
01	*Nasutimimus emersoni* (Seevers)	0000111110110110110101010001010
02	*Termitomimus entendveniensis* Trägårdh	1111001000011000000000101101100
03	*N. latipes* (Seevers)	0100111010100010010101100000000
04	*T. sheasbyi* n.sp.	1001001110000000000100100101100
05	*T. coatoni* n.sp.	1001001000111011001100101001100
06	*T. pretoriusi* n.sp.	1011000001111000000010101101111
07	*T. alzadae* n.sp.	1001001010111000000110101101100
08	*T. hettyae* n.sp.	1001001010111001000000000101100
09	*T. seeversi* n.sp.	1111000001111000000010001111101
10	*T. vanderlindei* n.sp.	1001001000111000000110001101100

The distribution of these characteristics in the 10 species is given in Table 1. These data were then read into an IBM 1620 computer together with a program to produce the simple matching coefficients described by Sokal and Michener (1958). To check the program and the machine, one simply superimposes the data cards for 2 species, counts the holes where the light goes through and divides by the total number of characters less the total characters coded "3" for either or both species. The matrix of these was then loaded back into the computer together with another program to perform the cluster analysis using the weighted pair group method described by Sokal and Sneath (op. cit). For small matrices, the IBM 1620 with 20K cores and disk drive can be used efficiently, but it becomes very time consuming for larger matrices, when you have to keep going to and from the disk all the time. However, for this size matrix the total time involved was 45 minutes, so the machine can handle it quite nicely.

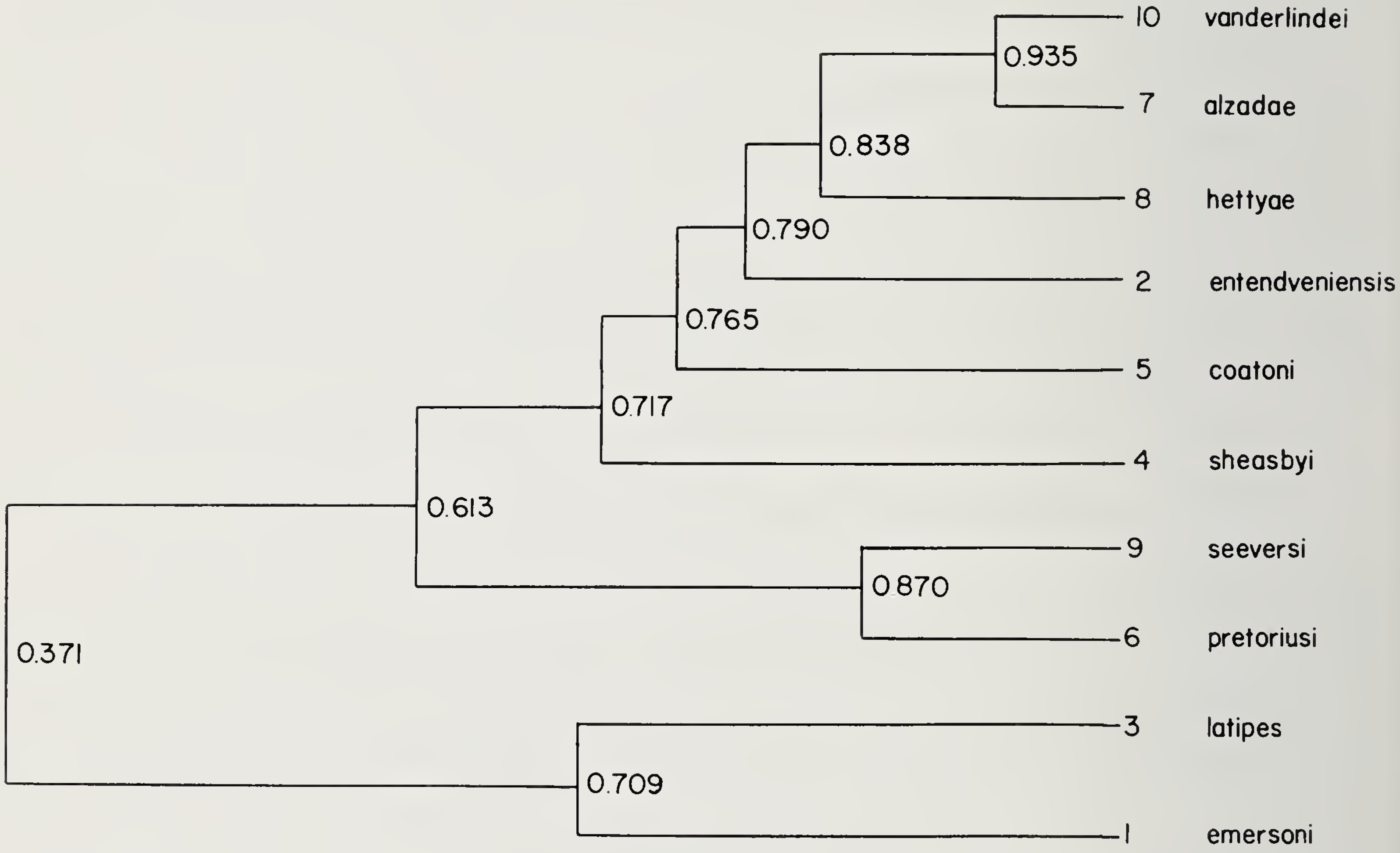

Fig. 8. Diagram of the phenetic relationships between the species of *Termitomimus* and *Nasutimimus*. Values indicate the value at the clustering intersections.

The results of these analyses are presented in fig. 8. The species here separated off into *Nasutimimus* cluster out together and at a relatively low correlation with the species here placed in *Termitomimus*. I really cannot take issue with any of the groupings. There is no doubt in my mind that *T. vanderlindei* and *T. alzadae* are more closely related to each other than to any of the rest of the species. The same is true of *T. seeversi* and *T. pretoriusi*. The species *T. hettyae, T. entendveniensis, T. coatoni,* and *T. sheasbyi* all cluster out stepwise to the *T. alzadae-T. vanderlindei* cluster. This happens because these species are really more closely related to *T. alzadae* and *T. vanderlindei* than they are to each other. This can be verified by checking the coefficients of association in Table 2. The mechanics of the clustering program make them join as shown in fig. 8. This is not serious so long as you know what it means when looking at the diagram.

Table 2.

Matrix of simple matching coefficients of the species of *Termitomimus* and *Nasutimimus.*

Species No.	2	3	4	5	6	7	8	9	10
1	.290	.709	.483	.419	.258	.419	.451	.193	.419
2	1.000	......	......	......	......	......	......	......	......
3	.451	1.000	......	......	......	......	......	......	......
4	.483	.580	1.000	......	......	......	......	......	......
5	.741	.516	.677	1.000	......	......	......	......	......
6	.774	.290	.580	.645	1.000	......	......	......	......
7	.806	.516	.806	.806	.774	1.000	......	......	......
8	.774	.483	.774	.774	.677	.838	1.000	......	......
9	.774	.290	.516	.580	.870	.709	.677	1.000	......
10	.806	.451	.741	.806	.774	.935	.838	.774	1.000

Before pursuing this further, 2 points should be discussed. These are the possible role of postimaginal growth and the host relationships. Seevers (1957) described and presented 3 remarkable photos showing postimaginal growth in *Nasutimimus emersoni* (Seevers). I restudied the same material and came to the same conclusions he did. These changes were fully shown by Seevers and will not be reiterated here. With the above correlation of 4 species to *T. alzadae* and *T. vanderlindei,* together with 2 species being found with each termite sometimes in the same nest, it naturally occurred to me to question whether *T. vanderlindei* was perhaps not the juvenile form of *T. coatoni*; *T. alzadae* the juvenile form of *T. pretoriusi, T. hettyae* the juvenile form of *T. entendveniensis,* and *T. sheasbyi* the juvenile form of *T. seeversi,* or if any of these relationships might hold true. I cannot prove that this is not the case but the material does not permit me to say that it is, for unlike Seevers' material, there are no intermediates. And there are no intermediates in spite of the fact that we have nearly 5 times as much material as Seevers had. As the species now stand they are all discontinuous series, and as such they are being interpreted as separate species. This also means that Seevers' comments about postimaginal growth are now restricted to the genus *Nasutimimus.*

The host relationships of the species are presented in Table 3. It will be noted that there are question marks in front of some of the host names. These colonies were so determined by W. A. Sands as stated in the notes appended to the termitophile species in question. However, Sands (1965, p. 77) states, "*Trinervitermes* is the most difficult genus in the Nasutitermitinae, and perhaps in the order Isoptera. In both imagoes and soldiers there is wide variation, and few reliable taxonomic characters. . . . In the case of the soldier caste, only the major soldiers are identifiable to species." Somewhat more specifically, he states (p. 88), "The range of variation in the soldier caste (of *T. dispar*) overlaps with *T. rhodesiensis, T. rapulum,* and *T. togoensis.* Some specimens of *T. rhodesiensis* and *T. rapulum* are indistinguishable from some *T. dispar.* . . ." Again he later states (p. 112), "*T. rapulum* is extremely difficult to separate from *T. rhodesiensis* in many samples of both imago and soldier castes, and these may be regarded as siblings, being partially sympatric." There are only 5 disputed colonies in the lot. In view of the fact that the termitophiles are rather easy to distinguish, I submit that the termitophiles are more sensitive indicators of the termite species in this instance than the termites are themselves.

Table 3.

Host relationships of *Termitomimus* and *Nasutimimus*.

Termitophile	Host
T. alzadae	*Trinervitermes rhodesiensis* (Sjoestedt) ? *T. rapulum* (Sjoestedt) ? *T. dispar* (Sjoestedt)
T. coatoni	*Trinervitermes dispar* (Sjoestedt)
T. entendveniensis	*Trinervitermes trinervoides* (Sjoestedt)
T. hettyae	*Trinervitermes trinervoides* (Sjoestedt)
T. pretoriusi	*Trinervitermes rhodesiensis* (Sjoestedt) ? *T. rapulum* (Sjoestedt) ? *T. dispar* (Sjoestedt)
T. seeversi	*Baucaliotermes hainesi* (Fuller)
T. sheasbyi	*Baucaliotermes hainesi* (Fuller)
T. vanderlindei	*Trinervitermes dispar* (Sjoestedt)
N. emersoni	*Nasutitermes infuscatus* (Sjoestedt)
N. latipes	*Nasutitermes arborum* (Smeathman)

Now if we combine all this into an evolutionary interpretation of this generic group, we have to start with the most primitive stock being the genus *Nasutimimus* for reasons stated earlier. These are associated with *Nasutitermes.* The next most primitive stock would then be the cluster *T. alzadae-T. vanderlindei* from which at an early date the cluster *T. pretoriusi-T. seeversi* split off. This would have to have occurred prior to the separation of the genus *Baucaliotermes* from *Trinervitermes.* Also early, the cluster *T. entendveniensis-T. hettyae* would have to separate from the *T. alzadae-T. vanderlindei* stock, probably prior to the separation of *T. alzadae* and *T. vanderlindei.* Also this could have occurred separately, but it is more probable that they are derivatives from each other because the termite hosts have not evolved to the point where they are given separate names. Finally, *T. sheasbyi* probably evolved from *T. alzadae,* while *T. coatoni* probably evolved from *T. vanderlindei.* This is all consistent with the figures in the similarity coefficient matrix but is a slightly different interpretation than is possible with the clustering techniques used. It is not, however, inconsistent with those results.

If we assume that host specificity is complete and the 5 disputed colonies are *T. rhodesiensis,* then the host relationships would be as follows. At the generic level, *Nasutitermes* would be most primitive, *Trinervitermes* would be derivative from that, and *Baucaliotermes* would be derivative from *Trinervitermes.* These results are consistent with those of Ahmad (1950) and Sands (1965). At the species level, *Trinervitermes dispar* should be more closely related to *T. rhodesiensis* than to *T. trinervoides. Trinervitermes trinervoides* should be more closely related to *T. rhodesiensis* than to *T. dispar* and *Baucaliotermes hainesi* should be more closely related to *T. rhodesiensis* than to the other 2 termite species. It will be interesting to hear what termite specialists think of this.

The rates of evolution then would not be the same. For instance, *Termitomimus hettyae* separated from *T. entendveniensis* even though the termites did not sufficiently evolve to deserve specific separation. This is consistent with a statement by Sands (1965, p. 77), "An interesting result is that the localized operation of distinctive genes or gene complexes has been observed in certain species. . . ." This is the result of partial isolation of populations of species with wide distributions. Since the termites are far more numerous than the termitophiles, what may be partial isolation so far as the termites are concerned could very well act as complete isolation for the termitophiles.

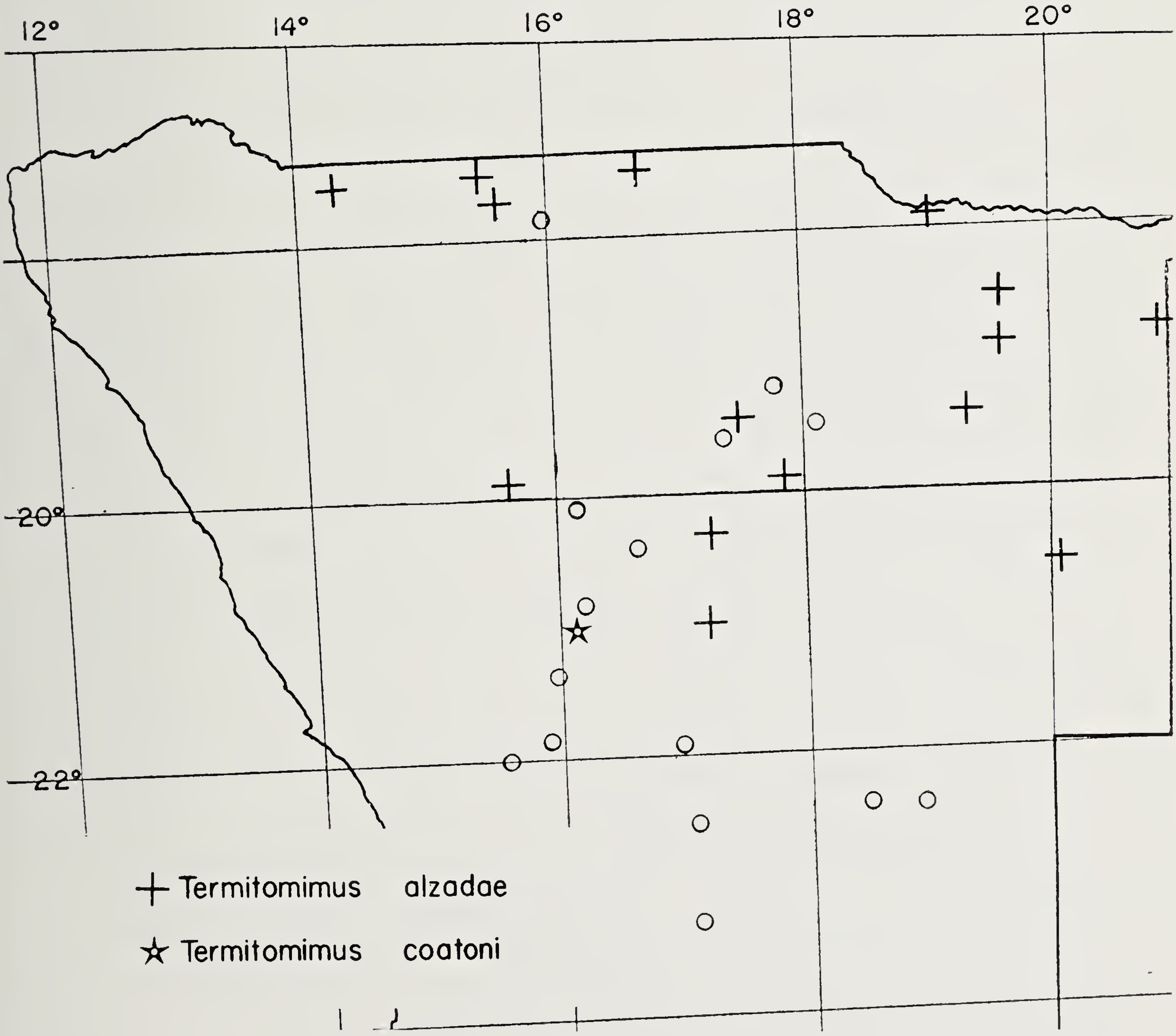

Fig. 9. Distribution of 2 species of *Termitomimus* in South-West Africa. Map was redrawn from the Surveyor General's Map, Windhoek. Open circles represent the location of the larger cities.

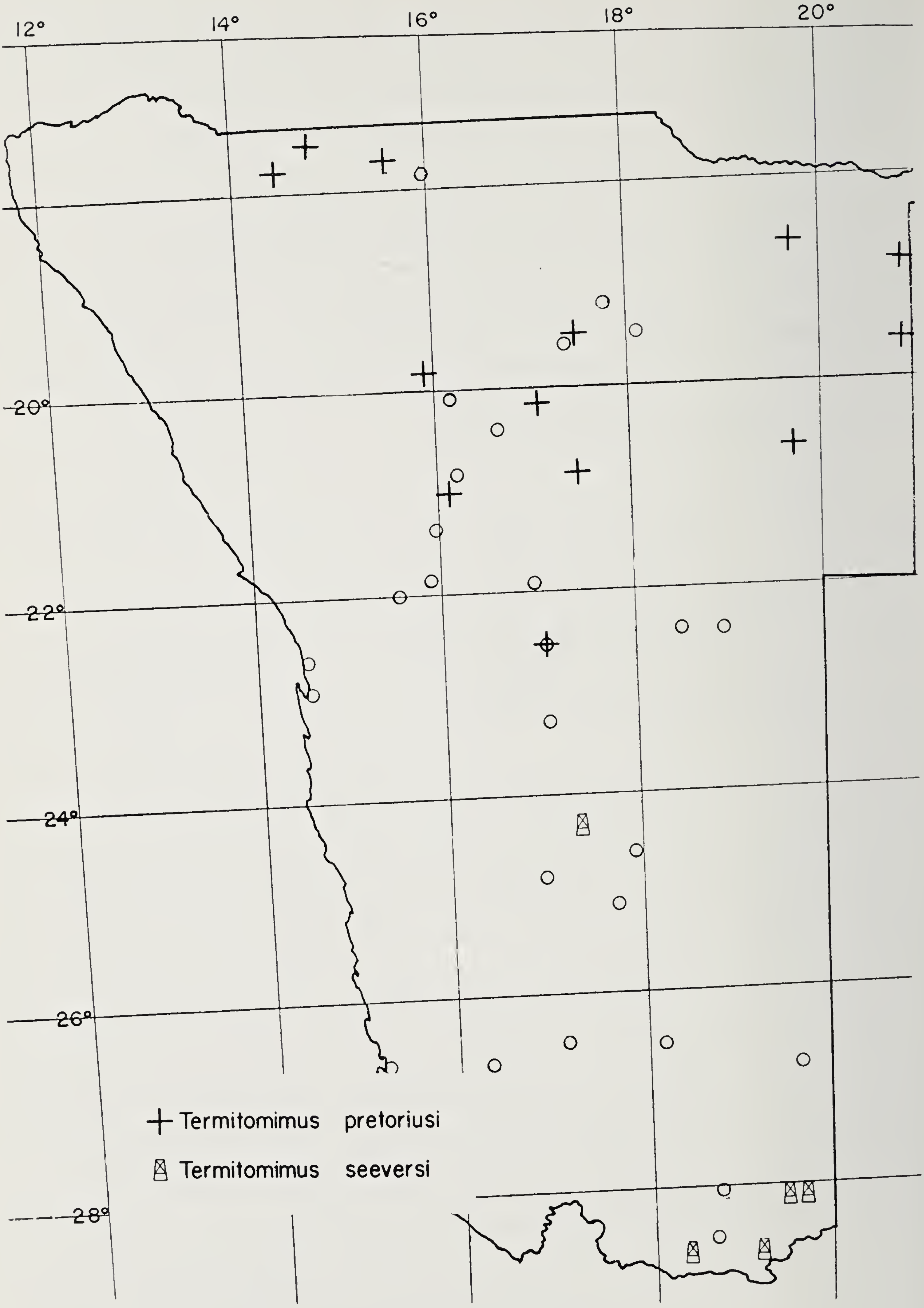

Fig. 10. Distribution of 2 species of *Termitomimus* in South-West Africa. Open circles represent the location of the larger cities.

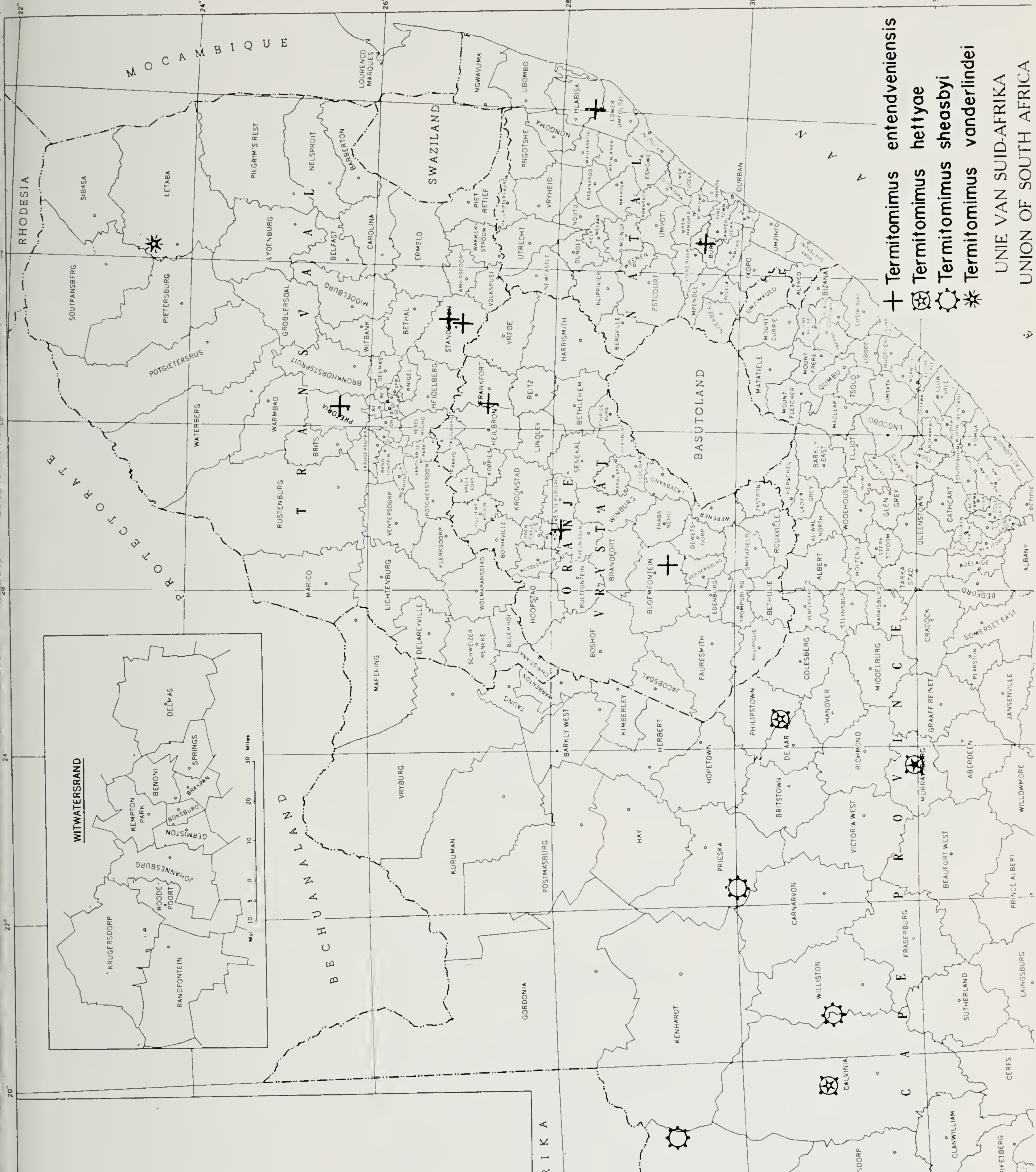

Fig. 11. Distribution of *Termitomimus* sp. in the Republic of South Africa.

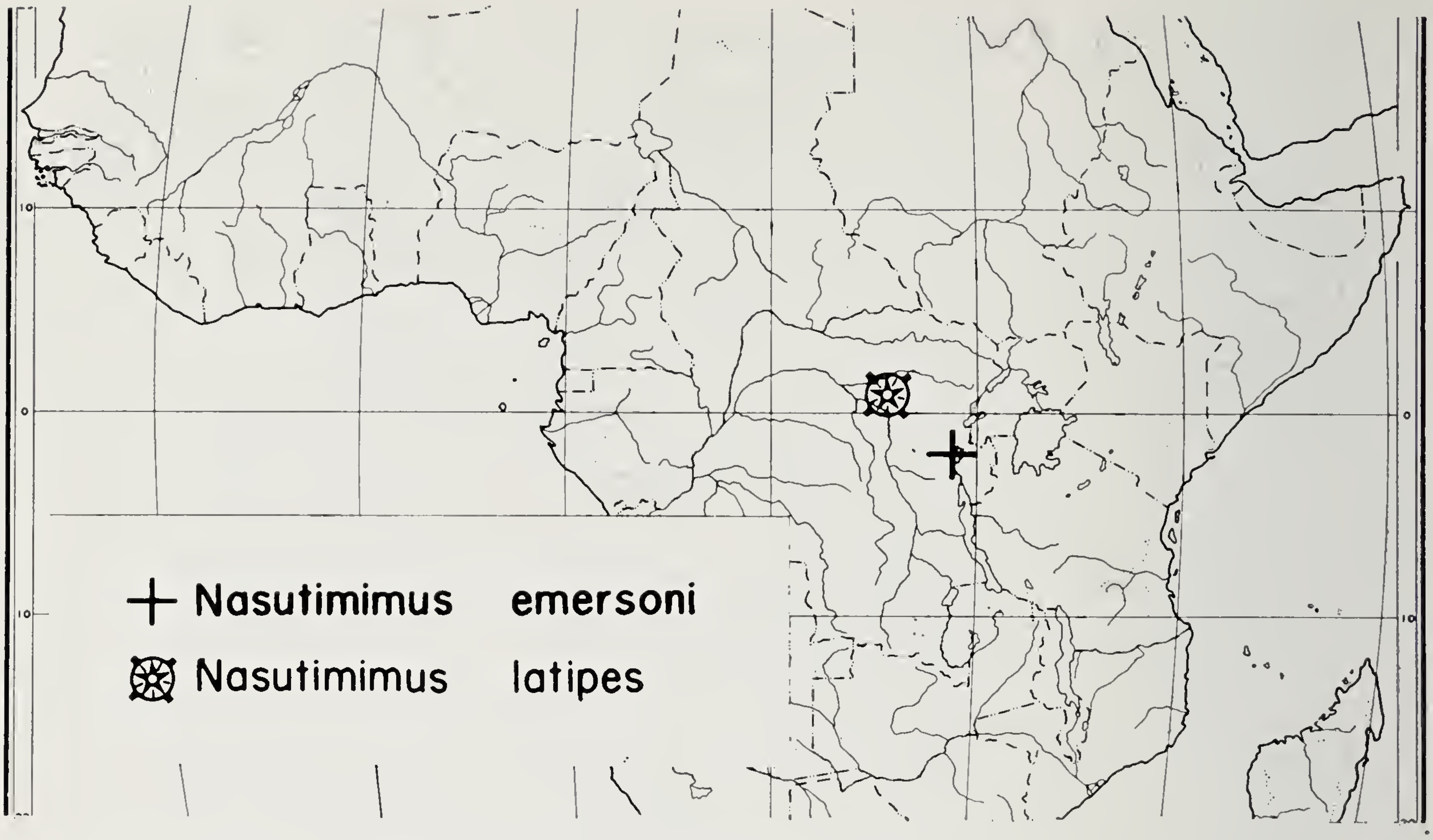

Fig 12. Distribution of *Nasutimimus* sp. in Central Africa.

Acknowledgments

For providing the vast majority of the specimens included in this study, I am deeply grateful to Dr. W. G. H. Coaton, Plant Protection Research Institute, Pretoria, Republic of South Africa. I also want to thank his colleagues, Mr. J. L. Sheasby and Mr. G. F. Pretorius for their collecting efforts to get these most elusive specimens.

I am also grateful to Dr. R. L. Wenzel, Field Museum of Natural History, Chicago (FMNH) and Mr. R. D. Pope, British Museum (Natural History), London (BMNH) for providing space, facilities, and easy access to the collections under their supervision while studying specimens germane to this paper. The initials given in parentheses above are used to indicate the institutions where specimens cited are deposited. Those deposited in the National Collection of Insects, Pretoria, are cited (NCI) while those retained in my collection, eventually to be deposited in the Field Museum of Natural History, are cited (DK).

Termite host identifications are all individually credited in the text, but I want to again express my thanks to Dr. W. G. H. Coaton and Mr. W. A. Sands, Termite Research Unit at the British Museum (NH) for taking the time to do the determinations. I wish to thank Dr. Alfred E. Emerson for reading the manuscript and making critical comments on it.

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On a reported new genus of Ptiliidae, *Macdonaldium* Abd. & Abd., from Canada.

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Svartskog, Norway

In the Ent. News 78:77-83, Abdullah & Abdullah (1967) described a new *Ptiliidae* genus, *Macdonaldium*, with a new species, *fungi*, from East Como, Quebec, Canada. The authors observed that no investigation had been made with regard to the family *Ptiliidae* in Canada though a number of genera occur at least in the Lake Superior district. In this connection they referred to *Pteryx, Ptenidium,* and *Ptinellodes* and also point to *Actidium* which is known from British Columbia, California, and Texas. In the opinion of the authors, *Macdonaldium* is the first endemic *Ptiliidae* genus from Quebec.

With a view to a proposed revision of the nearctic *Acrotrichis* species, I requested the loan of the type material of *Macdonaldium fungi* for investigation. Professor V. R. Vickery of the Lyman Entomological Museum, where, according to the description, the typical pair is kept, states, however, that no such type specimen was found among the specimens Abdullah left upon leaving for Pakistan.

Even without an investigation of the type specimen, it can be stated, upon the basis of the description and drawings, that *Macdonaldium* is the same genus that Motschulsky (1848) set up under the name *Acrotrichis.* Consequently, *Macdonaldium* Abd. & Abd., 1967, has to be listed as a synonym of *Acrotrichis* Motschulsky, 1848, which is a valid name. In an earlier publication (Sundt, 1958) I have shown that any *Acrotrichis* species, the description of which does not comprise the genital characters, must be considered as *nomina dubia* until available type material is dissected, the genitalia examined, and the species redescribed with regard paid to these organs.

Concerning *"Macdonaldium" fungi,* probably belonging to the subgenus *Ctenopteryx* Flach, 1889, one is not able from the description and drawings to undertake a species identification. Even if the type material should turn up later, it would hardly be possible to determine the species on the basis of the fragmentary remnants of which the male type and female allotype seem to consist according to the drawings. *Macdonaldium fungi* Abd. & Abd., 1967, must therefore be considered a *nomen dubium* because of incomplete description and deficient type material.

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A New Species of Xenorhipis from Mexico with a Key to the Males (Buprestidae)

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Interest in the distribution of the species of *Xenorhipis* was stimulated by the collection of *X. alvarengai* Cobos in Brazil (Cobos, 1964). Until that discovery no *Xenorhipis* was known from south of Texas and the Bimini Islands. A new species has been taken in the states of Sonora and Oaxaca, Mexico and is described below. This helps to fill the formerly large gap in the distribution of this genus. In order to facilitate the identification of the species of *Xenorhipis* a key to the males is included. The females of *X. alvarengai* Cobos and *X. mexicana* Nelson are unknown.

Xenorhipis mexicana Nelson, NEW SPECIES
(Fig. 1)

Elongate, narrow; above black with irridescent blue-green on head except at middle, on basal and lateral pronotal margins, and on triangular area at base of elytra; elytra with aeneous tint on apical two thirds and with obscure purplish reflections at apex; below black with irridescent blue-green or purplish reflections at sides of meso- and metasterna, on abdomen and femora; mouthparts, antennae, and tarsi testaceous; setae inconspicuous above, slightly more evident below.

MALE—Head convex with median sulcus on vertex ending below in foveola on front between upper part of eyes; surface reticulate on front, granulose on vertex; antennae flabellate, rami beginning with second joint.

Pronotum transversely quadrate, sides parallel, slightly rounded in front, lateral margins inferior in front; anterior margin sinuate with median lobe broadly rounded; basal margin slightly sinuate; disk slightly flattened at middle, short groove at apex, base with midline fovea and depressions laterally; surface reticulate basally, punctate-granulose anteriorly. Scutellum transversely oval, disk depressed, chagreened.

Elytra at base as wide as pronotum, lateral margins sinuate; each elytron constricted to narrowest at middle leaving midline gap, apices rounded; sutural and lateral margins serrulate; disk flattened, slightly depressed at base; surface granulose, more coarsely apically.

Beneath densely punctured toward middle of sterna, reticulate laterally and on abdomen, background chagreened; prosternum not lobed; large sensory pit on side of metasternum clothed with long golden setae; last visible abdominal sternite semicircularly emarginate with apical angles serrate.

Length 5.3 mm; width 1.5 mm.

FEMALE—Unknown.

Type material: *Holotype*, male (California Academy of Sciences, Entomology, San Francisco) and two paratypes from Mexico, Oaxaca, 3 miles west of Tehuantepec, 2 August 1965, on *Acacia pennatula* (S. & C.) limbs, G. H. Nelson; 2 males, same place, 9 July 1965, G. H. Nelson; 1 male, same place, 19 July 1965, G. H. Nelson; 1 male, Mexico, Sonora, 15 miles east of Navajoa, 20 July 1965, on *Acacia* sp., D. S. Verity; 1 male, Mexico, Sonora, 9 miles north of Hermosillo, 30 July 1966, on *Olneya tesota* Gray, D. S. Verity. Paratypes in the collections of D. S. Verity and the writer.

Variations.—The irridescent areas are reduced in some and in one are almost absent while in one from Sonora the irridescent areas are more evident. In one there is a trace and in two a more evident testaceous area at the narrowest part of the elytra. The sides of the pronotum are slightly sinuate in one and a bit rounded in others. The paratypes vary from 4.2 to 5.9 mm in length and from 1.2 to 1.7 mm in width.

Comparisons.—This species is most similar to X. *alvarengai* Cobos but differs in the general body color being blackish instead of blue, and in the shape of the elytra. It differs from the other species as indicated in the following key.

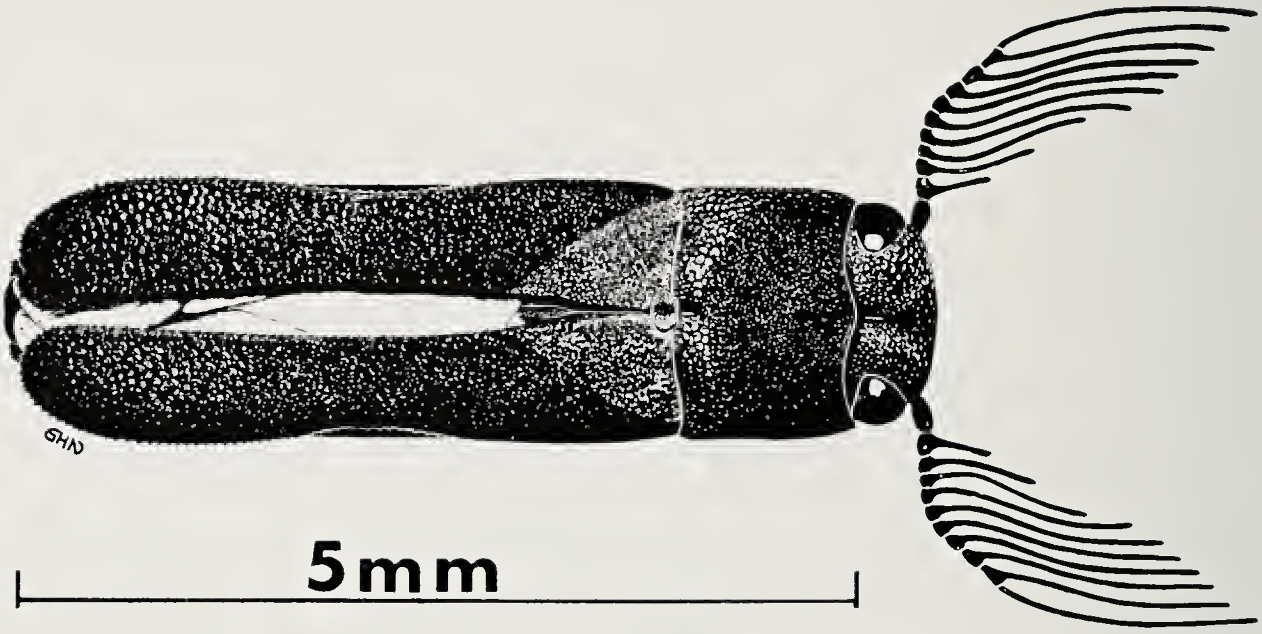

Figure 1. *Xenorhipis mexicana* Nelson, new species, holotype.

Key to Males of the Genus Xenorhipis

1 Disk of pronotum dark cupreous, posterior pronotal angles brilliant cupreous; elytra with testaceous triangular spot extending from lateral margin behind umbone diagonally back to middle (Bahama Islands).................................... X. *vauriei* Cazier

1′ Color and maculations different.................................... 2

2 Elytra covering but three abdominal segments; white fascia on middle of elytra extending from lateral margin nearly to suture with oblique extension anteriorly from sutural to humeral region (Texas).................................... X. *osburni* Knull

2′ Elytra covering more than three abdominal segments; white fascia, if present, not as above.................................... 3

3 Elytra constricted at middle from lateral and sutural margins leaving midline gap between elytra; elytra without oblique light markings (Fig. 1, Mexico).................................... X. *mexicana*, NEW SPECIES

3′ Elytra not constricted or constricted only from lateral margin leaving no gap between elytra; elytra usually with oblique light markings............ 4
4 General body color a dull blue with violet on elytra and middle of pronotum (Brazil)............ *X. alvarengai* Cobos
4′ General body color dark bronze or aeneous............ 5
5 General color of head, pronotum and elytra bronze; elytral apices finely serrulate (Texas)............ *X. hidalgoensis* Knull
5′ General color of head, pronotum and elytra darker bronze; elytral apices more coarsely serrulate (Eastern United States, Texas)............ *X. brendeli* Leconte

Acknowledgments

The writer is grateful to Mr. D. S. Verity for the loan of material used in this description.

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NOTE

Entomology Division of New Zealand Department of Scientific and Industrial Research (Box 223, Nelson) is the main institution engaged in systematic research on New Zealand insects. At present the Systematics Section comprises Dr. G. Kuschel (Leader, Curculionoidea), Dr. J. C. Watt (Cucujoidea, especially Tenebrionidae, beetle larvae), Dr. G. W. Ramsay (Orthoptera and Acarina), Dr. A. C. Eyles (Hemiptera), Mr. J. S. Dugdale (Lepidoptera and Tachinidae), Mrs. B. M. May (larvae of Curculionoidea) and four technicians. Taxonomic research is undertaken also by other officers of the Division, e.g. Dr. J. M. Hoy (Director, Melolonthinae larvae and Coccoidea), Mr. E. W. Valentine (Chalcidoidea), Mr. W. Thomas (Ichneumonoidea), Mr. L. J. Dumbleton (Hepialidae, Simuliidae, ticks, etc.) and Mr. B. B. Given (Scarabaeidae).

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—J. CHARLES WATT

Hypnoidus leei, A New Species of click beetle from North America (Coleoptera, Elateridae)

Jeffrey N. L. Stibick[1]
Department of Entomology, Purdue University

The species described here was separated in a research study preliminary to publication of a revision of the Hypnoidinae of the world.

Hypnoidus leei NEW SPECIES

(Fig. 1,2)

This species can be distinguished from its close relatives by the very sparse longitudinal-mediad directed setal pattern of the pronotum, these being so sparse as to preclude criss-crossing in the median line; by the sparse scutellar and elytral pubescence; and by its size of 6 mm or more.

MALE: Length 6-8 mm, width 2.2-2.5 mm; shape oblong, moderately convex; color piceous to testaceous; appearance smooth and shiny; sparsely punctate; vestiture yellowish, very sparse above, yellowish and somewhat sparse beneath. *Head:* Twice as long; front flat, border feebly elevated; coarsely, but not closely, punctate. Antennal scape expanded; pedical ½ length of third segment; 4th to 10th segments feebly serrate; last segment ovate-oblong; relative segment lengths as follows, (2.4+1.1+1.4+1.3+1.2+1.2+1.2+1.2+1.2+1.2+2.0). Apical segment of maxillary palpus expanded halfway from base, forming an acute triangle. *Pronotum:* not quite twice as wide as head (3.25/5.5), wider than long (4.75/5.5), slightly narrowed in front; sides arcuate, widest at middle, slightly or not at all sinuate in front of hind angles, these feebly everted, carinate, incised at base; disk moderately convex; median impression very feeble; moderately punctate; pubescence very sparse, setal pattern longitudinal-mediad, no crossing on median line. Pleural region opaque, large and small punctures closely intermixed. Prosternal lobe moderately prominent; punctation moderate; prosternal mucro narrowly, sharply concave, surface vaguely micro-reticulate. Metasternum pubescence sparse, yellowish; ratio of length of second abdominal segment to length of metasternum (1.3/3.5 or .371). Scutellum flat, form oblong-oval (2.25/2.7), heavy black border on truncated anterior edge; surface scarcely pubescent, with yellowish setae; sparsely punctate. Elytra wider at middle than thorax (4.2-3.9 mm), length (2.75-2.95 mm), shape oblong, humeri obtusely rounded; disk moderately convex; striae deep and well formed, punctate, rather sparsely so in middle; intervals flat, sparsely, finely punctate. *Abdomen:* Piceous to brownish-yellow; fine punctures intermixed with slightly larger punctures; pubescence yellowish, somewhat sparse.

---

[1] Approved by the Agricultural Experiment Station, Purdue University, Lafayette, Indiana, as Journal Paper No. 3367. Present address: 3617 N. Rockingham St., Arlington, Va. 22213.

Male genitalia: Trilobate; parameres freely movable on the penis. Parameres moderately slender, ratio of width to length (1/7.3 or more), sides sinuate near apex; lobes present and moderately large. (see fig. 2)

FEMALE: Similar to male. Female internal genitalia (not figured) is typical for the genus, and similar to that of *H. squalidus* Becker (1958).

LARVA and Ecology are unknown.

Type Material: The *Holotype* male, has the following data: "Cambrea Pass, Col. VI-21-35," "Alt. 1,000 ft.", "Van Dyke Collection." Allotype female and six paratypes (1 female, 5 males) with the same data. There are thirty-seven other paratypes (21 female, 16 males) as follows:

ALBERTA: 10 W. Cayley, 19-V-66 (C. E. Lilly), found under rocks, (2 females, 1 male). ARIZONA: White Mts. (2 females). COLORADO: Antonito (1 male), Garland 30-6 (Hubbard and Schwarz) (1 female); Ouray, Ouray Co., 7,500-8,000 ft., July 1-15, 1897 (H. F. Wickham) (1 female); Horse Fly Peak, Ouray Co. 85-10,000 ft., July 10-11, 1885 (1 female); Mts. S.W. of Montrose, Montrose Co. 9-10000 ft., July 9-10, 1885 (Roland Haywood) (2 females, 3 males). IDAHO: Franklin Basin, July 7, 1955 (S. L. Wood) (1 male). NEVADA: (No locality) (3 females, 1 male). NEW MEXICO: Jemez Mts. V-24 (Jao Woodgate) (2 female, 1 male). Santa Fe, Santa Fe Co. (1 female). UTAH: (No locality) (Van Dyke collection) (1 female, 2 males); Utah Lake, Utah Co. (2 males, 1 female). WYOMING: Cheyenne, Laramie Co., 4-2-89 (3 females, 2 males); Green River, Sweetwater Co. (1 female); Laramie, Laramie Co. (1 female); Sublette Co. (1 female); Yellowstone Park 7-10000 ft., 10-12-V11-1936 (S. M. Williams) (1 male); National Park 30-7, (Hubbard and Schwarz) (1 male).

Status: There is little discernible variation, other than color, between individual specimens of *H. leei.* In collections this species may be found among specimens of *H. nocturnus* Esch. and has also been confused with *H. bicolor* Esch. and *H. rivularius* Gyll. *H. nocturnus,* however, is confined to the Pacific Coast, while *H. bicolor* possesses a dense pronotal vestiture of comparatively long setae which generally criss-cross at some point along the median line. *H. rivularius* is distinguished by short, reddish pronotal setae, all directed caudad. In addition *H. bicolor* and *rivularius* are usually smaller (4 mm). The male genitalia of each of the aforementioned species is diagnostic.

The Holotype, allotype, and eleven paratypes are in the collection of the California Academy of Sciences, San Francisco. Five paratypes are in the collection of the U. S. National Museum, Washington, D. C., six in the Museum of Comparative Zoology, Cambridge, Mass., three in the University of California, Berkeley, California, four in the Canadian National Collection at Ottawa, Canada, one in the University of Kansas, Lawrence, Kansas, and one in the University of Michigan, Ann Arbor, Michigan. Six paratypes are deposited or placed in the author's collection, one in the Purdue Entomological Research Collection, and one in the British Museum.

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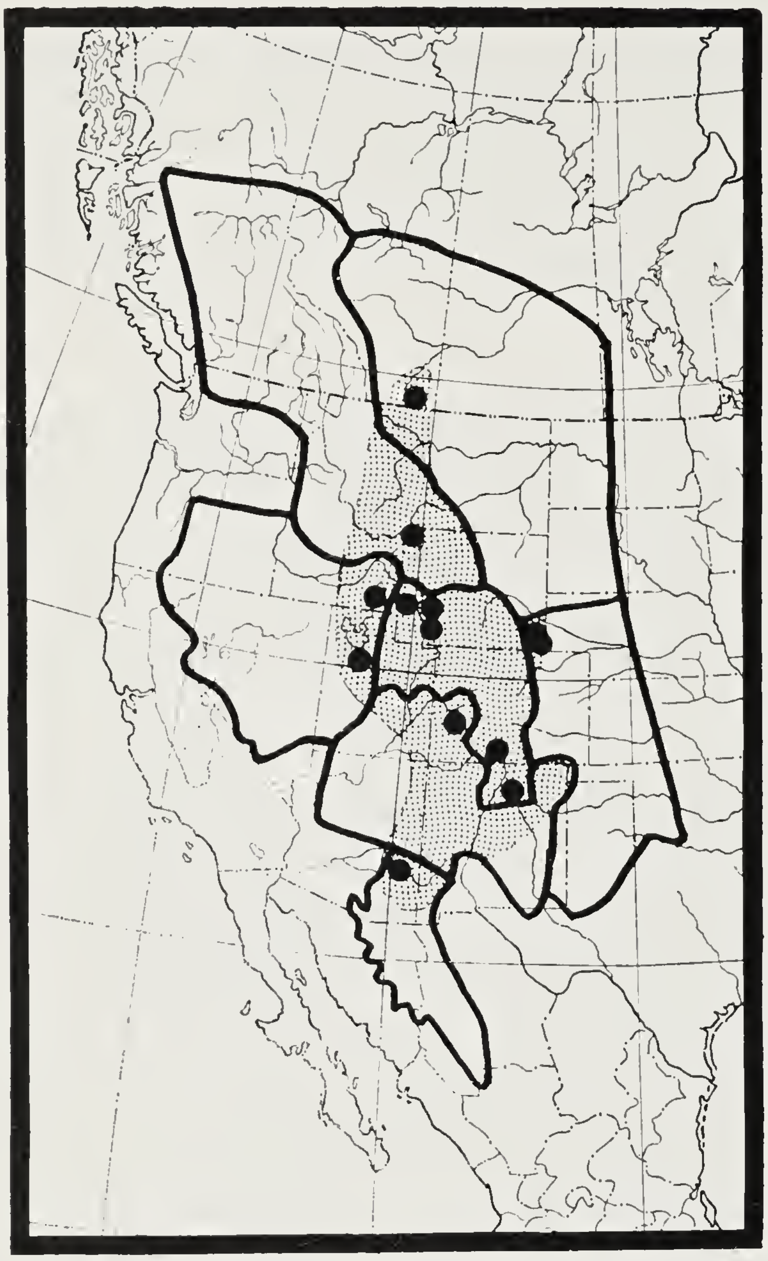

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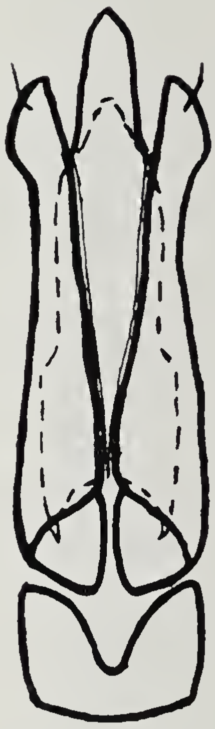

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FIGURE 1. Distribution of *Hypnoidus leei* n.sp. Heavy lines represent Biotic Provinces after Dice, 1943.*

FIGURE 2. *Hypnoidus leei* n.sp. male genitalia, dorsal view.

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NOTICE

A Directory of Collections of Coleoptera in North America will be published this November. Several hundred collections, federal, state, municipal, university, and private will be listed. The area covered will include all of North America from Canada through Panama. The entries describe the collection, its size, scope, storage, and personnel. Over 500 collections have been contacted by the Purdue University sponsor, the Center for the Study of Coleoptera and the response has been unanimous.—R. H. A.

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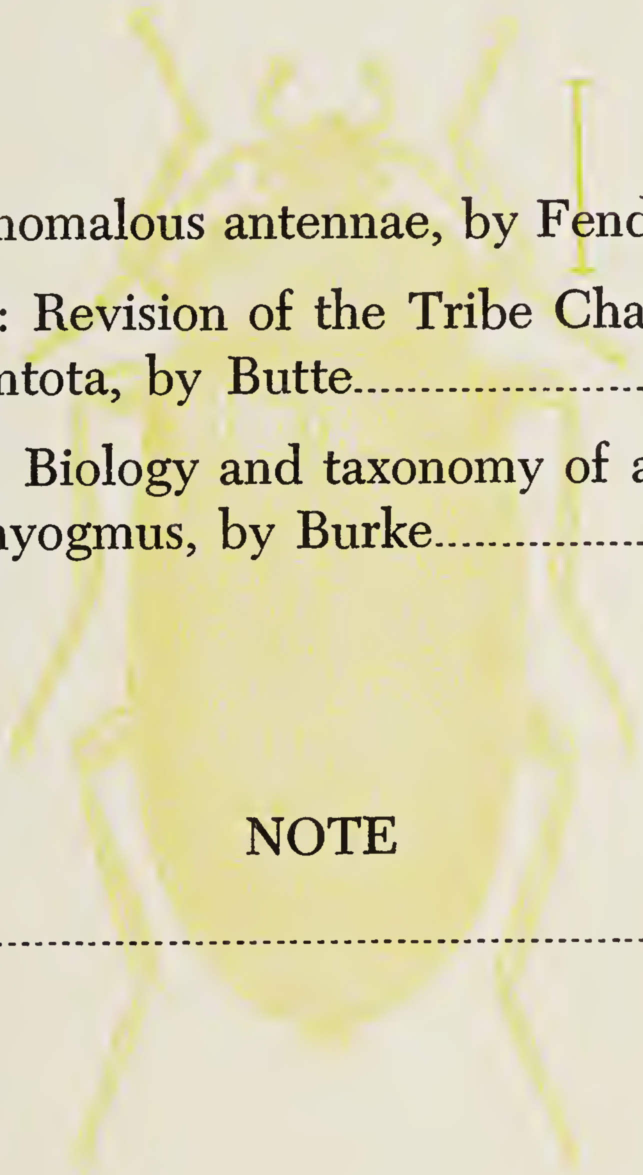

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Founded 1947 by Ross H. Arnett, Jr.

The Coleopterists' Bulletin is published by the Department of Entomology, Purdue University, Lafayette, Indiana 47907 as a part of the projects of ACSIC, (A Center for the Study of the Insect order Coleoptera) and is edited by Dr. N. M. Downie. It is issued four times a year beginning with March. All business matters as well as editorial matters and manuscripts may be sent to the above address.

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THE COLEOPTERISTS' BULLETIN
VOLUME 22 DECEMBER 1968 NO. 4

The Revision of the Tribe Chalepini of America North of Mexico. III. Genus *Odontota* Chevrolat (Coleoptera, Chrysomelidae)[1]

Janardhan G. Butte
State University of New York, Farmingdale, N. Y.

Introduction

This revision of *Odontota* Chevrolat is the third in a proposed series reviewing the six genera of Chalepini of America North of Mexico. The second, a revision of the genus *Chalepus* Thunberg, 1805, was published in the Journal of the New York Entomological Society, 22(2), (Butte, 1968b).

Odontota Chevrolat, 1837, (Dejean Cat., p. 364 of the "1833" edition, p. 388 of the "1836" or "1837" edition[2]) was proposed for forty-one species. Out of the forty-one species only nine are now listed as valid under four different generic names in the catalogue by Weise (1911b). Four of these nine species were listed in *Xenochalepus* by Weise, but two of these four species should be transferred to *Odontota*, since for reasons given below, they are not considered to be congeneric with other species of *Xenochalepus*.

Recent papers on neotropical hispids (Weise, 1910; Spaeth, 1937) proposed changes of nomenclature affecting the generic assignment of some of our species. It is now proposed to readopt the generic name *Odontota* Chevrolat which was long used as a valid genus for some North American species but listed as a synonym of *Chalepus* in the catalogue of Gemminger and Harold (1874-1876). The name was published and is available by application of Article 12 and 16 (a) (V) of the International Code of Zoological Nomenclature. *Odontota* became available by inclusion of several available specific names, (Chevrolat, 1837:388) in combination with the new genus-group name. The species of *Odontota* are strikingly different from other species of *Xenochalepus* or *Chalepus*.

The species of this genus closely resemble *Xenochalepus* in their general appearance, by the prominence of clypeus and frontal ridge, by the presence of ten and one-half rows of punctures on elytra, and by the structure of the genitalia. However, these two genera are easily separated by the following sets of char-

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[1] From a dissertation submitted in partial fulfillment of the requirements for the Ph.D. degree at the Catholic University of America, Washington, D. C., 1966.

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[2] The above cited pages are identical in several broken or defective characters and are without doubt assignable to 1837, as stated by Barber and Bridwell, 1940:2. Page 364 in the 1833 copy shows more wear than that in 1837 copy and adds support to the theory that the former (1833 edition) was completed by reissuing part 5 of the latter (1837) with changed pagination and that part 5 of the 1837 volume has priority.

acters in which those for *Odontota* are given first and those for *Xenochalepus* second: Form oblong; form cuneiform. Clypeal base subangulate; clypeal base angulate. Frontal carina usually cristulate; frontal carina usually cristate. Pronotal baso-lateral torulose absent; pronotal base-lateral torulose present; Each elytron distinctly tricostate; each elytron distinctly bicostate. Apices of elytra regularly rounded; apices of elytra conjointly rounded. Sutural angles of elytra rectangulate; sutural angles of elytra deeply subquadrate-emarginate. Aedeago-flagellum usually short and its anterior end away from foramen; aedeago-flagellum usually long and its anterior end close to foramen.

The species of *Odontota* and *Chalepus* can be segregated by the following sets of characters in which those of *Odontota* are given first and those for *Chalepus* second: Form oblong, sides gradually but slightly dilated from base to apex; form elongate, sides parallel. Clypeal apex more arcuate, base subangulate; clypeal apex feebly arcuate, base angulate. Frontal carina strongly developed and usually cristulate; frontal carina feebly developed and usually cristate. Each elytron with eleven rows of punctures at base; each elytron with ten rows of punctures at base.

The measurements used here were described previously by Butte (1968a).

ODONTOTA Chevrolat

Odontota Chevrolat, 1837:388; Crotch, 1837:80; Chapuis, 1875:138; Horn, 1883: 290, 294; Chittenden, 1902:86.

Type Species of Genus. Odontota scapularis (Olivier) 1808:766 by present designation. (Location of type, Museum National d' Histoire Naturelle, Paris.)

Diagnostic Features of Genus. Form oblong. Each elytron distinctly tricostate extending from base to apex with eleven striae at base. Sutural angles of elytra rectangulate and not emarginate. Apices of elytra regularly rounded.

Description of Genus. The species of *Odontota* are wedge-shaped or oblong; length from 5.5 to 7.3 mm.; males are generally larger than the females. *Head:* slightly wider than long. Vertex trisulcate, area between ocular and median sulci finely rugo-punctate. Frontal ridge cristulate, shape varies, either elongate or diamond-shaped. Antennae vary in length, basal segment incrassate. Clypeus strongly transverse; surface microgranulose or coarsely tuberculose; raised prominently, base subangulate, lies close to antennae and slightly overhanging toward base. Mandibles robust, no longer than broad; size and shape of apices varies; outer margin of each mandible is rather broadly and evenly arcuate. *Pronotum:* transverse, generally widest medially; lateral margins angulo-subrotundate at middle, bisinuate; dorsum transversely convex, posterior depression may be present or absent; a baso-lateral torulose on either side of posterior depression absent. Apex of last tarsal segment varies in shape between the bases of claws. *Elytra:* oblong; gradually but slightly dilated from base to apex; the latter regularly rounded; apical sutural angle rectangulate; outer margin may be serrulate or absent. Each elytron with ten, at the extreme base with eleven, rows of punctures. *Abdomen:* with 5th visible sternum generally truncate; female with a small irregular patch of setae on central elevation which in the male is hardly perceptible.

Male Genitalia. Aedeagus from moderately to heavily sclerotized and showing considerable curvature from below. Size of basal foramen varies in different species. Antero-dorsal wall of foramen strongly convex or slightly concave. Apical orifice varies from small to large, V-shaped or lunulate. Apical hood large, triangulate or cordate. Strut keeled and flattened dorsally. Flagellum usually short, its anterior end away from foramen. Spiculum varies in shape.

Distribution. The members of this genus as here recognized are distributed in eastern and central parts of the United States. This genus is represented in North America by seven species.

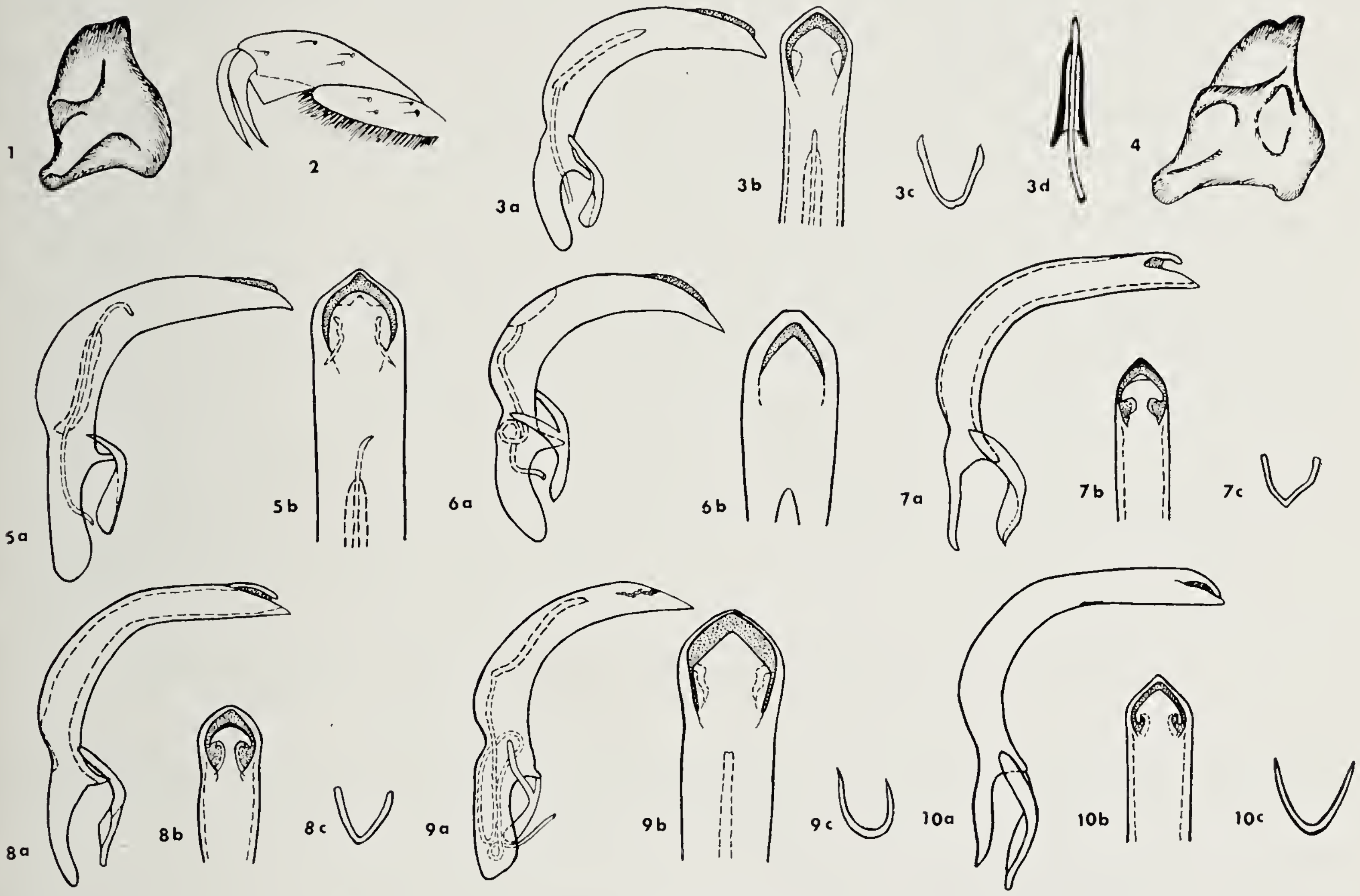

PLATE I

Plate I. Figs. 1-10.

Fig. 1. Mandibles of *O. mundulus* (dorsal view)
Fig. 2. Claws of *O. mundulus* (lateral view)
Fig. 3a-3d. Male genitalia of *O. mundulus*
Fig. 4. Mandibles of *O. scapularis* (dorsal view)
Fig. 5a-5b. Male genitalia of *O. scapularis*
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Fig. 9a-9c. Male genitalia of *O. dorsalis*
Fig. 10a-10c. Male genitalia of *O. horni*

Explanation of Figures

The drawings of the genitalia pertaining to the same species have been given the same number with the addition of letters, a, b, c, d, to distinguish the different views and parts: a, lateral, or slightly dorsolateral, view of aedeagus and tegment; b, dorsal, or dorsocaudal, view of aedeagus; c, dorsal, or dorsocaudal view of spiculum gastrale; d, flagellum.

Key to the Species of Odontota of North America

1. Lateral margins of pronotum with black vittae 2
1′. Lateral margins of pronotum without vittae 3
2. Prosternum and legs entirely black; elytral punctures distinctly elongate towards apex in first two striae .... *mundulus* (Sanderson)
2′. Prosternum orange-red; profemora orange-yellow at base; elytral punctures not elongate .... *scapularis* (Olivier)
3. Mandibles distinctly bidentate; clypeus elongate; sides of abdominal sternites 3-4 pale yellow .... *arizonicus* (Uhmann)
3′. Mandibles monodentate; clypeus strongly transverse; sides of abdominal sternites 3-4 black 4
4. Elytra entirely black 5
4′. Elyrta reddish-yellow, with black sutural stripe 6
5. Mesosternum entirely black; elytral margin not serrulate; eye width equal to intreocular distance .... *notata* (Olivier)
5′. Mesosternum orange-yellow; elytral margin distinctly serrulate; eye width wider than interocular distance .... *floridanus* n. sp.
6. Prosternum black; elytral margin dentate, sutural black stripe broadening gradually from base to apex; apex of last tarsal segment deeply cleft at base of claws .... *dorsalis* (Thunberg)
6′. Prosternum yellow; elytral margin not dentate; sutural black stripe widest near base, not reaching apex; apex of last tarsal segment feebly sulcate at the base of claws .... *horni* Smith

1. Odontota mundulus (Sanderson, 1951) New Combination

(Figs. 1; 2; 3, a, b, c, d; Plate II)

Xenochalepus mundulus Sanderson, 1951:162. (Location of type: in the collections of the Illinois Natural History Survey, Urbana, Illinois.)

Type Locality. Oglesby, Illinois.

Diagnostic Features. Very similar to *O. scapularis* (Oliv.), but may be readily separated by the presence of the following characters:

The absence of yellow marks on base of femora and underside of prothorax; and also elytral punctures in the inner two rows are slightly elongate toward apex instead of rounded; elytral margin not serrated. Aedeago-flagellum less than one-third the length of aedeagus; apically rectate.

Description of Species. Male. Virginia, Fairfax Co., Vienna, May 17, 1934, J. C. Bridwell collector (NSNM).

Length 5.5 mm.; width 2.5 mm.; wedge-shaped. *Head:* length/width ratio, .833. Frontal carina diamond-shaped. Antennae 1.5 mm. in length; 2nd segment cylindrical; segments 3-5 obconic; 3rd about one-third longer than 2nd and 4th. Clypeus coarsely tuberculose. Labrum prominent, crescentic, dorsally with row of fine hairs centrally. Mandibles robust, monodentate, cutting edges broad (fig. 1). Eye width less than the width of clypeus, and equal with dorsal interocular space. *Pronotum:* length 0.8 mm.; width 1.3 mm.; lateral margins parallel on basal three-fifths, then obliquely converging to the apex. Dorsum transversely convex, depressed posteriorly with ante-scutellar transverse ridge; surface coarsely and deeply foveo-punctate; interstices subcristate. Medial line basally distinct, apically evanescent. Legs normal; apex of last tarsal segment deeply cleft (fig. 2) between the bases of claws. *Elytra:* length 4.6 mm.; width 2.4 mm.; outer margin finely serrulate, but not so distinctly as in *O. scapularis.* Elytral punctures generally rounded, but distinctly elongate toward apex in 1st and 2nd striae near suture, with feeble apical carina between 6th and 7th rows of punctures. *Abdomen:* sparsely micro-punctate; 5th sternum apically truncate and hardly perceptible setae on either side of median elevation.

Color. Pronotum bicolored, a large median black spot widest at base and narrowing toward apex; lateral margin of pronotum broadly black at center and narrowing to anterior and posterior angles of pronotum; remaining area of pronotum uniformly orange-red. Each elytron at basal one-fifth with elongate yellow triangular area extending from base of inner costa to lateral elytral margin. 5th visible sternum laterally bright yellow. Venter and legs black.

Male Genitalia. Aedeagus heavily sclerotized and showing greater curvature from below (fig. 3a). Basal foramen slightly smaller than one-fourth the length of aedeagus; strongly convex antero-dorsally running into a prominent concave depression at one-third of the aedeagus. Lateral plates (fig. 3b) small, triangular and regular. Tegmen V-shaped with short acute ends. Strut short, and close to foramen. Flagellum stout, broad at base and narrowing toward apex (fig. 3d). Length of flagellum less than one-third the length of aedeagus. Spiculum (fig. 3c) V-shaped, somewhat asymmetrical.

Female. Fifth abdominal sternum with a small, irregular patch of setae on either side of central elevation.

Biology. "These beetles live upon and the larvae mine in the leaves of the 'hog-peanut', variously called *Falcata comosa* L., *Amphicarpa dioica* or *Amphicarpaea dioica.* About 30 specimens were collected on this host-plant at Vienna, Va. (12½ mi. west of Washington, D. C.), May 17, 1936, by the late Mr. J. C. Bridwell in contrast with a similar series of *O. scapularis* (Oliv.), collected at the same time and place but on the 'ground nut' to which host-plant *scapularis* is peculiar. Other series include samples taken or reared by Bridwell on the same host-plant in the vicinity of Washington at Glen Echo, Md., June, 1928, and June 10, 1930." (Data from H. S. Barber, unpublished.)

Larvae. Undescribed.

Variation and Discussion. The size variation is as follows: total length: males 5.4-5.6 mm., females 6.0-6.2 mm.; elytral length: males 4.2-4.5 mm., females 4.6-4.7 mm.; elytral width: males 2.1-2.3 mm., females 2.4-2.6 mm. The total length of males is less than the females and shows sexual dimorphism of total length.

The pronotum has a large median black spot, widest at base and narrowing towards apex; in some specimens this spot is basally confluent with the lateral marginal vitta.

The description given by Blatchley (1910:1226) for *O. scapularis* is partly applicable to *O. mundulus* (Sanderson).

Distribution. The general distribution of *O. mundulus* (Sanderson, 1951) is indicated on Plate II. This species is known from Massachusetts southward to Texas and westward to Nebraska and has been collected from late May to late August, mostly in June and July.

Specimens Examined. 209: MASSACHUSETTS: Suffolk Co., Brookline, 2 (CAS); 2, (MCZ). Montgomery, 1, (MCZ). No further data: 4, (MCZ). Hampden Co., W. Springfield, 2, (USNM), Norfolk Co., Wellesley, June 2, and 23, 1912, 4 males, 2 females, P. G. Bolster, (MCZ). RHODE ISLAND: Bristol Co., Bristol, 1 male, N. S. Easton, (MCZ). CONNECTICUT: Middlesex Co., Cormwell, 1, (CU). New Haven Co., New Haven, 3, (CU). Sound Beach, 1, (AMNH). NEW York: Nassau Co., Sea Cliff, 2, (MCZ); Little Neck, 2, (CAS). Westchester Co., White Plains, 1, (CNHM). New York City and vicinity, 1935, 5, C. Schaeffer, (USNM); 1, (AMNH). Riverdale, 2; Brownville, 9; Rahway, 1; Van C. Pk., 3, (AMNH). Maurlain Lake, 1, (CNHM). Patterson, 4, (CU). No further data: 9, (AMNH); 1933, 2, Wickham, (USNM). PENNSYLVANIA: E. Park, 2, R. Hopping, (CAS). Wind Gap, Aug. 3, 1947, 3, J. W. Green, (CAS). No further data: 2, Liebeck, (MCZ); 1, (AMNH). 2, F. C. Bowditch, (MCZ). NEW JERSEY: Passaic Co., Paterson, July 25, 1, J. A. Grossbeck, (AMNH). Bergen Co., Ridge Wood, June 22, 1911, 1, M. D. Leonard, (CU). Alpine, 3; Eagle Rock, May 8, 1, (AMNH). A. Fenyes, 5, Beyer; Hillside, August 6, 1922, 1, Quirfield, (CAS). No further data: 1935, 3, C. Schaeffer, (USNM). MARYLAND: Plummers Island, July 26, 1914, 1, Q. L. McAtee; July 20, 1913, 7, W. D. Appel, (USNM). Montgomery Co., Glen Echo, summer, 1922, 18, J. C. Bridwell, (USNM). Baltimore, June, 1902, 5, Van Dyke, (CAS). Forest Glen, July 6, 1913, 1; May 30, 1914, 1, (USNM). DISTRICT OF COLUMBIA: No further data: 1, (AMNH). VIRGINIA: Fairfax Co., Vienna, May 17, 1936, 30, J. C. Bridwell, (USNM). Glen Carlyn, May 18, 1, Banks, (MCZ). Four-mile Run, May 31, 1914, 1, A. Wetmore, (USNM). Buffalo Ck., July 5, 1927, 1, Chamberlain, (CU). No further data: June 6, 1941, 1, Borys & Malkin, (CNHM). WISCONSIN: Dane Co., Madison, May 31, 1931, 1, Chas. L. Fluke, (CNHM). ILLINOIS: Carroll Co., Savanna, July 29, 1892, 1, McElfesh, (CAS). Knox Co., Galesburg, 3, Liebeck, (MCZ). Glenview, July 2, 1911, 20, Blaisdel; Riverside, June 6, 1913, 3, L. S. Slevin, (CAS). Edgebrook, 1940, 4, Moznette, (USNM). No further data: May 26, 1912, 3, Chamberlain, (CU). Northern Illinois, 4, E. A. Klages, (CU). MISSOURI: Jackson Co., Kansas City, 4, H. Soltan, (USNM). IOWA: Johnson Co., Iowa City, 4, Wickham, (USNM). NEBRASKA: Douglas Co., Omaha, Childs Point, May 22, 1909, I. F. H. Shoemaker, (CAS). KANSAS: No further data: 1933, I. Wickham, (USNM). TEXAS: No further data: 3, C. V. Riley, (USNM).

2. Odontota scapularis (Olivier, 1808) New Combination

(Fig. 4; 5, a, b; Plate II)

Hispa scapularis Olivier, 1808:766.

(Location of type: Museum National d' Historie Naturelle, Paris.)

Type Locality. "Carolina", U. S. A.

Hispa lateralis Say, 1823:431; LeConte, 1857:204.

(Synonymized). (Location of type: Unknown to me.)

Type Locality. "Illinois and Missouri".

Odontota scapularis (Olivier), Chevrolat, 1837:388; Crotch, 1873:80; Horn, 1883: 295-296; Chittenden, 1902:86.

Chalepus scapularis (Olivier), Gemminger and Harold, 1876:3614; Blatchley. 1910:1226; 1924:43; Maulik, 1937:136; Wilcox, 1954:471-472.

Xenochalepus scapularis (Olivier), Weise, 1911 (a):28, Leng, 1920:303; Uhmann, 1938:428; Sanderson, 1951:163.

Diagnostic Features. This species bears a deceptive resemblance to *O. mundulus,* and may be confused with it in collections, but may be separated from the latter by the following characters:

Prosternum orange-red. Profemora orange-yellow at basal one-third. Elytral punctures not elongate toward apex in first two striae; its outer margin distinctly serrulate. Aedeago-flagellum is about one-third the length of terminal part and bears a long curved cylindrical process at its apex.

Description of Species. Male. Florida, Orange Co., Winterpark, March 15, 1929, J. G. Gehring collection, (MCZ).

Length 6.5 mm.; width 2.7 mm.; oblong oval. *Head:* length/width ratio, .875. Frontal carina elongate. Antennae 2.0 mm. in length; 2nd segment cylindrical; 1st and 2nd equal in length; 3rd about 1.4 times as long as 2nd and 1.7 times as 4th; 4th and 5th subequal in length; 4th cylindrical; 5th obconic; 6th about one-third shorter than 5th. Clypeus finely granulose. Labrum prominent; arcuate; broader than long. Mandibles bidentate (fig. 4), apical tooth acute. Eye width equal with the width of clypeus and interocular space. *Pronotum:* length 1.0 mm.; width 1.8 mm.; lateral margin angulo-subrotundate at middle, narrowing anteriorly and obliquely more so posteriorly. Dorsum convex, slightly depressed posteriorly with the ante-scutellar transverse ridge; surface coarsely, deeply foveopunctate, each separated by about one-half their diameters, interspaces shiny, sparcely alutaceous. Medial line well-defined with shallow longitudinal groove. Legs normal; apex of last tarsal segment deeply bifid at the base of claws. *Elytra:* length 5.1 mm.; width 2.7 mm. Outer margin distinctly but finely serrulate. Elytral punctures generally rounded. A feeble basal carina between 6th and 7th rows of punctures. *Abdomen:* impunctate: 5th sternum apically truncate, and with scarcely perceptible setae on either side of central elevation.

Color. Pronotum bicolored; a large median piceous spot, widest at one-third from ante-scutellar transverse ridge and narrowing to point behind anterior pronotal margin; lateral margins broadly black, dark area narrowing to posterior and anterior angles of pronotum; remaining area orange-red; ventrally prosternum and prosternal episternum orange-red. Elytra black; the basal one-third of its length with an elongate yellow triangular area extending from the base of inner-costa to the lateral elytral margin. The profemora orange-yellow at basal third; the other femora with orange-red spot beneath at basal third. The lateral sides of 5th sternum orange-yellow.

Female. The 5th abdominal sternum with a small, irregular patch of setae on either side of central elevation.

Male Genitalia. Aedeagus moderately sclerotized and showing considerable curvature from below (fig. 5a). Basal foramen large, equal to one-fourth the length of aedeagus; feebly convex antero-dorsally and running into a depression at one-third from base. Lateral plates (fig. 5b) large and irregular. Tegmen U-shaped with short acute ends. Strut elongate, close to foramen. Flagellum stout, broad at base, gradually narrowing into a long, curved, cylindrical process at apex; its length equal to one-third the length of aedeagus.

Biology. "This species has been collected on and reared from larvae in the indigenous plant 'ground nut' known as *Glycine apias* L. or *Apios tuberosa* Moench; at Vienna, Va. and other localities near Washington, D. C. by the late Mr. Bridwell on several occasions," (H. S. Barber; unpublished). Adults reared from this host plant by Dimmock at Springfield, Mass. in 1901 and by C. R. Ely in Conn. in 1910 are also before me. Popence, 1877 from Kansas; Blatchley, 1910 from Indiana and Maulik, 1937 also reported the same host plant.

Larvae. Illustrated by Needham, Frost and Tothill (1928:183).

Variation. Size variation is as follows: total length: males 6.3-6.5 mm., females 7.2-7.8 mm.; elytral length: males 5.1-5.2 mm., females 5.9-6.2 mm.; elytral width: males 2.6-2.7 mm., females 3.2-3.5 mm. The total length of males studied is considerably less than the length of the females, and thus shows striking sexual dimorphism of total length.

In some specimens there is a small irregular orange-red spot at the center of the mesosternum, and at the base of mesocoxa and mesotrochanter. In some specimens the above mentioned coloration is totally absent. In some specimens there is a small indistinct piceo-rufous patch running at the base of frontal carina, in others it is absent. Humeral color range varies from one-third to one-half of the length of elytra. The color range at the base of meso- and metafemora varies from a well-marked orange-red spot to a hardly perceptible coloration. The description given by Blatchley (1910:1226) for *O. scapularis* is partly applicable to *O. mundulus* (Sanderson).

Distribution. The general distribution of *Odontota scapularis* Olivier, is indicated on Plate II. This species is known in the east from southern Canada to Florida and in the west from Michigan to Texas and has been collected from late March to early September, mostly in June and July.

Specimens Examined. 253: 84 males, 109 females, 60 sex undetermined. *CANADA:* ONTARIO, Leamington, 12-VI-1940, 2 females; 3-VIII-1940, 1 male, 1 female, W. J. Brown, (CNC). *UNITED STATES:* MASSACHUSETTS: Norfolk Co., Wellesley, May 30, 1908, 1 female; June 2, 1912, 1 male; June 23, 1912, 1 male; June 8, 1913, 2 males, 2 females, 1?, Percy Gardner, (MCZ). Plymouth Co., Wareham, Aug. 18, 1898, 1 male, O. Bangs, (MCZ). Marion, June 11, 1903, 1 female; June 28, 1903, 1?; July 24, 1899, 1 female; July 20, 1899, 1 female; Aug. 1, 1903, 1 female, 1? June 30, 1 female, (MCZ). Suffolk Co., Brookline, 1 male, 1 female, F. C. Bowditch, (MCZ). Worcester Co., Southboro, June 29, 1913, 1 female, C. A. Frost, (MCZ); June 4, 1933, 1 female, C. A. Frost, (CAS). Hampden Co., Springfield, June 28, 1903, 1 male, 1 female, F. Knab; July 28, 1902, 1?, G. Dimmock, (USNM). Berkshire Co., Melrose High, August

19, 1908, 1 female, D. H. Clemons, (USNM). Barnstable Co., Woods Hole, August 15, 1927, 1 male, 1?, W. T. M. Forbes, (CU). Middlesex Co., Ashland, June, 1892, 1?, E. W. Mank, (CU); Framingham, May 31, 1905, 1 male; June 2, 1934, 1 female; June 12, 1957, 1 male, 1 female, C. A. Frost, (MCZ); Concord, August 18, 1939, 1 male, 2 females, H. R. Dodge, (CNHM). Fall River, May 21, 1906, 1 male; May 31, 1909, 1 male; June 6, 1909, 1 male, 2 females, N. S. Easton, (MCZ). No further data: Readville, 1 male, 1?, (AMNH); 27, Van Dyke, (CAS). RHODE ISLAND: Bristol Co., Barrington, June 6, 1908, 1 male, N. S. Easton, (MCZ). Watch Hill, June 30, 1909, 1 female, W. Robinson, (USNM). CONNECTICUT: Fairfield Co., New Canaan, July 15 and 25, 1949, 2 males, 2 females; June 3-July 30, 1950, 8 males, 12 females, 32?, M. Statham, (AMNH). East River, July 30, 1910, I?, Chas. R. Ely, (USNM). Lyme, June 17 and 18, 3 males, 4 females, 3?, W. S. Fisher, (USNM). NEW YORK: Brooklyn Co., Vicinity of New York, 1 male, 2 females, Chas. Pain, (AMNH). Suffolk Co., Wantagh, June 30, 1940, 1 female, 1?; July 22, 1939, 25?, Borys Malkin, (CNHM); Riverhead, June 20, 1934, 2 males, 2 females, H. Dietrich, (CU); Wyandanch, July 4, 1914, 3?, F. M. Schott, (CU); Yaphank, July 9, 1916, 1 female, (AMNH). Nassau Co., Cedarhurst, June 5, 1904, 1 male, females, L. B. Woodruff, (AMNH); Sea Cliff, May, 2 males, Bank, (MCZ). Westchester Co., Yonkers, May 30, 1940, 2 males, 3 females, Borys Malkin; Sept. 2, 1929, 1 female, Chas. L. Ragot, (CNHM). Richmond Co., Great Kills, July 6, 1940, 3?, Borys Malkin, (CNHM). Queens Co., Rosedale, July 3, 1937, 1 female; Aug. 10, 1938, 1 female, H. Gelfand; Oct. 3, 1926, 1 male, F. M. Schott, (CU). Princes Bay, June 22, 1914, 1 male, G. Kelley, (CAS). NEW JERSEY: Hudson Co., Bergenfield, May 20, 1933, 1 female, Borys Malkin, (CNHM); 1 male, F. M. Schott, (CU). Middlesex Co., Jamesburg, 1 male, (AMNH). Cape May Co., Cape May, May 30, 1949, 1 female, P. Vaurie, (AMNH); July 13, 1930, 5 males, 2 females, J. W. Green, (CAS). 5 M. Beach, 2 males, 3 females, H. A. Wenzel, (CNHM). Bergen Co., Alpine, June 10, 1937, 1 female, F. M. Schott, (AMNH). Anglesea, 6 males, 6 females, Van Dyke, (CAS); 2 males, J. W. Green, (CAS); 1 male, 4 females, Liebeck, (MCZ); 2 males, 2 females, E. L. Dickerson, (AMNH). Wenonah, 1 male, Liebeck, (MCZ). No further data: 1 female, F. A. Eddy, (MCZ). PENNSYLVANIA: Philadelphia Co., Philadelphia, 1 male, 1 female, Liebeck, (MCZ). Co. undet., Angora, 1 male, Liebeck, (MCZ). MARYLAND: Plummers Island, May 25, 1918, 1 male, Van Dyke, (CAS); May 26, 1912, 1 male, 2 females, W. L. McAtee, (USNM). DISTRICT OF COLUMBIA: Washington, July 27, 1937, 2 males, 2 females, H. S. Barber, (USNM). VIRGINIA: Falls Church, May 25, 1922, 1 female, E. A. Chapin, (USNM); 1 male, Banks, (MCZ). Fairfax Co., June 28, 1925, 1 female, J. M. Schott, (AMNH). Barcroft, May 25, 1912, 2 females, 1?, C. T. Greene, (CAS). NORTH CAROLINA: Wake Co., Raleigh, May 27, 1933, 1 male, May 23, 1941, 1 female, T. B. Mitchell, (UNC). Hyde Co., Swan Quarter, May 6 and 7, 1959, 1 male, 3 females, W. M. Kulash, (UNC). Hollyshelter, April 25, 1953, 3 males, H. and A. Howden, (UNC). Wilmington, 1 female, Packard, (MCZ). FLORIDA: Duval Co., Jacksonville, 1 male, 3 females, Mrs. A. T. Slosson, (AMNH). Orange Co., Winterpark, March 15, 1929, 1 male, 2 females, 1?, J. G. Gehring, (MCZ). Pinellas Co., Clearwater, May 7, 1943, 1 male, B. Malkin, (CNHM); Dunedin, March 21, 1925, 5 males, 1 female, 1?, (CU). ALABAMA: Green Co., 5 mi. N. E. Eutaw, July 9, 1950, 1 male, 2 females, T. Cohn, P. Boone, and M. Cazier, (AMNH). MISSISSIPPI: Lowndes Co., Columbus, June 24, 1921, 1 female, C. J. Darke, (UCB). TEXAS: Nacogdoches Co., Garrison, May 9, 1952, 2 males, 4 females, M. Cazier, W. Gertsch, and R. Schrammel, (AMNH). MISSOURI: Cole Co., Jefferson City, 2 females, H. Soltan, (USNM). INDIANA: Dune Park, June 24, 1935, 1 male, 1 female, E. Dubois, (CNHM). MICHIGAN: Wayne Co., Detroit, 3 females, 1?, Hubbard and Schwarz, (USNM).

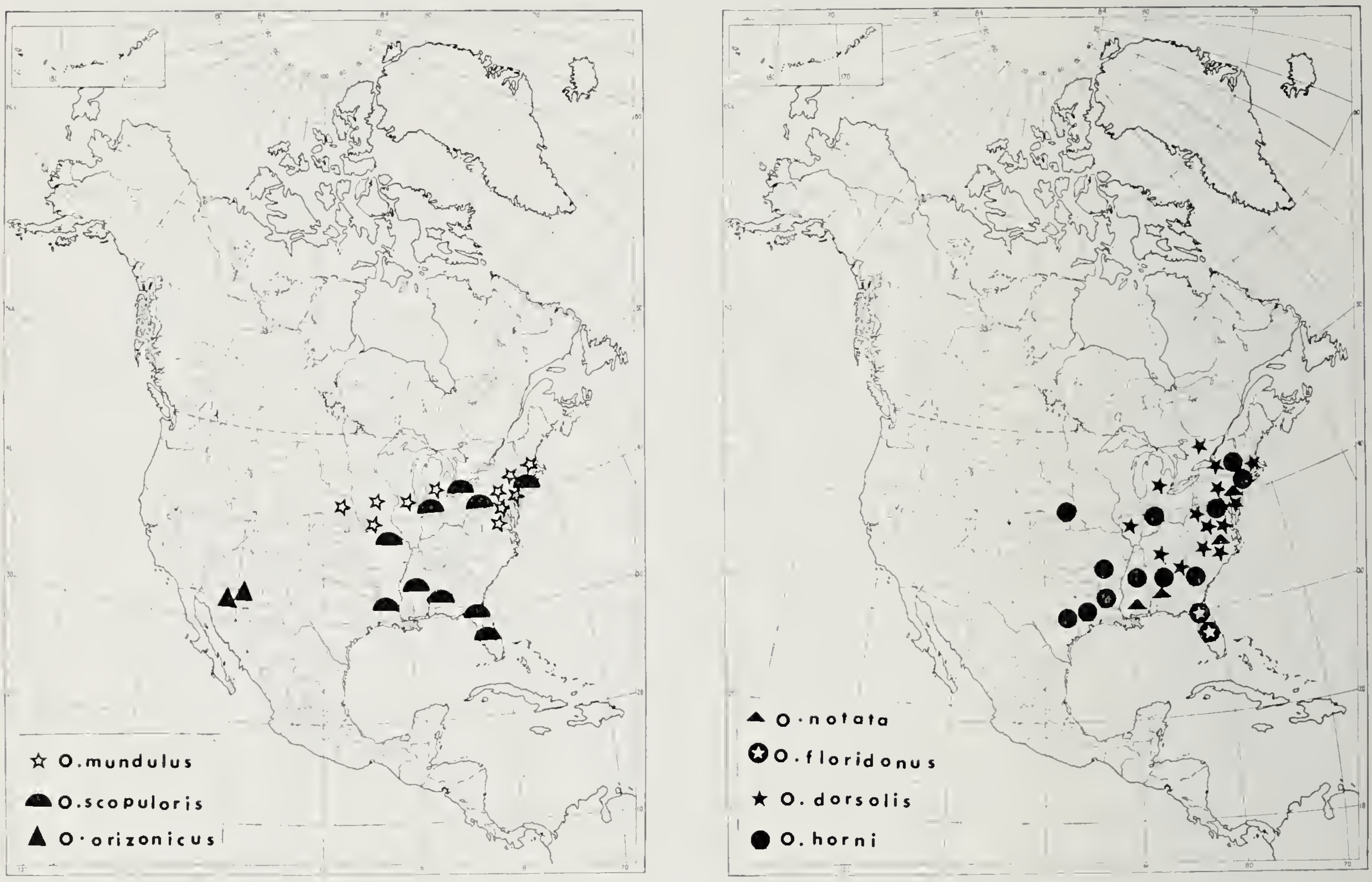

PLATE II

Plate II.
Distribution of species of *Odontota*

3. Odontota arizonicus (Uhmann, 1938) New Combination

(Fig. 6, a, b; Plate II)

Xenochalepus (Hemichalepus) arizonicus Uhmann, 1938:425, 426; Blackwelder, 1939:64; Uhmann, 1957:94; 1964:420. (Location of type: Zoologischen Museum der Universität Berlin.)

Type Locality. Arizona, Santa Cruz Co., Nogales.

Diagnostic Features. This species resembles *O. scapularis Olivier* in habitus, but may be readily separted from the latter by the presence of the following characteristics:

Clypeus coarsely tuberculate; legs entirely black; apex of last tarsal segment between the bases of claws feebly sulcate; abdomen with a narrow, bright yellow vitta at lateral sides; aedeago-flagellum equal to one-fifth the length of aedeagus.

Description of Species. Male. Arizona, Cochise Co., Douglas, Sept. 12, 1942, Wyatt W. Jones collector, (USNM).

Length 6.0 mm.; width 2.3 mm.; oblong, less robust. *Head:* length/width ratio, .625; wedge-shaped. Frontal carina elongate. Antennae 1.8 mm. in length; basal segment subglobate, segments 2-6 obconic; segments 1st to 5th, except 3rd almost equal in length; 3rd about 1.25 times as long as its presegment. Clypeus slightly elongate, surface coarsely and irregularly tuberculate. Labrum prominent; length twice its width. Mandibles distinctly bidentate, distadentis large, acute and sharp; proxadentis small, acute and sharp; apically a small, transverse groove visible. Eye transversely wider than the clypeus or than the dorsal interocular space. *Pronotum:* length 0.8 mm.; width 1.5 mm.; widest at base; subconic; lateral sides subparallel on basal one-third then slightly but distinctly angulate just beyond the middle, thence obliquely converging to the apex; obsoletely bisinuate. Dorsum transversely convex, slightly depressed posteriorly with ante-scutellar transverse ridge; surface closely orbiculo-foveolate; interspaces shiny, sparsely alutaceous and more widely spaced on the median area. Medial line well-defined with shallow longitudinal groove. Mesotibia with a small subapical conical tooth. Apex of last tarsal segment feebly sulcate at the base of claws. *Elytra:* length 5.3 mm.; width 2.4 mm. Outer margin distinctly serrulate, more coarsely so posteriorly and on the apical border. Punctures of elytra generally rounded, but slightly elongate towards apex in 1st and 2nd striae near suture; 8th interstice feebly costiform, finely but distinctly serrulate; the surface between strial foveae microscopically tuberculate. *Abdomen:* impunctate; 5th sternum apically slightly emarginate and with hardly perceptible setae on either side of median elevation.

Color. Prothorax yellow, except for a large transverse prescutellar black spot and a infuscate central area on prosternal empmeron; mesosternum, anterior one-fourth of metasternum yellow. A yellow area between hind coxae, involving lobes of the metasternum and the first visible ventral segment. Elytra black, the basal one-fourth of each with an elongate, triangular yellow area extending from the base of 1st costa to the lateral elytral margin. Abdomen with narrow bright yellow vitta at sides.

Male Genitalia. Aedeagus moderately sclerotized and showing greater curvature (fig. 6a) from below. Basal foramen slightly less than one-fourth the length of aedeagus; strongly convex antero-dorsally and running into a depression at slightly less than one-third from base. Apical orifice large (fig. 6b) and V-shaped. Lateral plates large, irregular and sub-triangular. Tegmen V-shaped, long, apex acute. Strut elongate, close to foramen. Flagellum stout, broad at anterior end and gradually tapering to acute posterior end. Length of flagellum equal to one-fifth of the length of aedeagus.

Female. The middle tibia of female with a small subapical conical tooth. Fifth visible sternum with a small irregular patch of setae on either side of control elevation.

Biology. Following are the unpublished data from the letter of Mr. Wyatt W. Jones to the late Mr. H. S. Barber. "I am sending about 150 specimens of *Chalepus* sp. taken on soybeans, *Glycine soja* (L) near Douglas on Sept. 12, 1942. It required only a few moments to collect the lot, many were copulating when I first noted the infestation. The damage caused by the adults, that is the feeding marks had attracted the attention of the farmer and he feared that the crop would be destroyed."

Variation. Size variation is as follows: total length: males 6.0-6.2 mm., females 6.6-6.8 mm.; elytral length: males 5.0-5.2 mm., females 5.3-5.5 mm.; elytral width: males 2.1-2.3 mm., females 2.5-2.6 mm. The total length of males studied is considerably less than the length of the females, and thus shows striking sexual dimorphism of total length. The size and shape of the notal spot varies in different specimens. Anterior metasternum yellow from one-fourth to one-half and in some Mexican specimens the flavescence extends up to metasternal lobes.

Distribution. The distribution of *Odontota arizonicus* is indicated on Plate II. This species is known from Arizona and it has been collected from middle of May to middle of September, mostly in August.

Specimens Examined. 153. ARIZONA: Cochise Co., Douglas, 12-IX-1942, 69; 10-IX-1942, 3; Aug. 26, 1942, 13, W. W. Jones, (USNM). Miller Cyn., Huachuca Mts., V-12-1962, 1, J. O. Martin, (CAS). Ft. of Miller Cr., S. Rita Mts., Aug. 16, 1940, 1, Van Dyke, (CAS). Sycamore Cn., Tumacacori Mts., June 28, 1940, 1, R. A. Flock, (CAS). Peppersauce Cn., Aug. 17, 1924, 1, (CAS). Pima Co., San Rita Mts., X-25-1936, 3, Bryant, (CAS); VI-14-1942, 42, Van Dyke, (CAS); Florida Cn., Santa Rita Mts., Aug. 10, 1924, 1, E. P. Van Duzee, (CAS); St. Xavier Mts., Tucson, Aug. 12, 1924, 1, E. P. Van Duzee, (CAS). Santa Cruz Co., 25 mi. E of Sonoita, VIII-3-1924, 1, E. P. Van Duzee, (CAS); Madera Cn., Santa Rita Mts., Sept. 18, 1936, 3, E. P. Van Duzee, (CAS); Nogales, Aug. 4, 1942, 12, mining on zinnia leaves, (USNM); Ruby, VII-27-1941, 1, E. L. Todd, (USNM).

4. Odontota notata (Olivier, 1808) New Combination

(Fig. 7, a, b, c; Plate II)

Hispa notata Olivier, 1808:744. (Location of type: in the collection of Bosc, Museum National d' Histoire Naturelle, Paris, France.)

Type Locality. "Carolina", U. S. A.

Odontota notata (Olivier), Crotch, 1873:80-81; Chapuis, 1877:13; Horn, 1883: 295-296; Chittenden, 1902:85.

Xenochalepus notatus (Olivier), Weise, 1911 (a):27; 1911 (b):40; Leng, 1920: 303; Uhmann, 1938:428, 437; 1957:104.

Chalepus notatus (Olivier), Frost, 1924:464.

Diagnostic Features. This species resembles *O. floridanus* n. sp. in color and habitus, but may be readily separated from the latter by the presence of the following characteristics:

Mesosternum black; frontal carina elongate; width of eye equal to the dorsal interocular space; outer elytral margin not serrulate. Aedeago-gastralae spiculum U-shaped; foramen wall antero-dorsally narrow in lateral aspect with a perceivable concavity.

Description of Species. Male. Mississippi, Jackson Co., Ocean Springs, July 13, 1930, H. Dietrich collector, (CU).

Length 5.5 mm.; width 2.3 mm.; oblong, robust. *Head:* length/width ratio, .777. Frontal carina elongate. Antennae 2.0 mm. in length; 2nd segment cylindrical; segments 3-6 slightly obconic; 1st and 2nd subequal in length. 3rd about 1.4 times as long as 2nd or 4th. Clypeus coarsely tuberculate. Labrum prominent, broader than long. Mandibles robust, cutting edges broad and sharp. Eye width equal to the width of clypeus and dorsal interocular space. *Pronotum:* length 1.0 mm.; width 2.0 mm. Lateral margins angulate in the middle, narrowing anteriorly and obliquely more so posteriorly. Dorsum regularly convex, with no traces of posterior depression; surface shallowly punctate; interstices subcristate, sparsely alutaceous. Medial line well-defined with shallow longitudinal groove. Legs normal, apex of last tarsal segment feebly sulcate at the base of claws. *Elytra:* length 4.4 mm.; width 2.3 mm. Outer margin not distinctly serrulate. Punctures of elytra generally rounded, but distinctly elongate toward apex in 1st and 2nd striae. There is a feeble apical carina between 6th and 7th rows of punctures. *Abdomen:* with 5th sternum truncate and hardly perceptible setae on either side of median elevation.

Color. Prothorax orange-red, except on dorsum a large, irregular black central spot and prosternal posterior margin infuscate. Meso- and metasternum entirely black. Abdominal 5th sternum laterally bright yellow. Legs and elytra entirely black.

Male Genitalia. Aedeagus heavily sclerotized and showing greater curvature from below (fig. 7a). Basal foramen small, equal to one-fifth the length of aedeagus. Foramen wall antero-dorsally narrow on lateral view with perceivable concavity, running into a depression at one-fourth from base. Apical orifice large (fig. 7b), lunulate. Apical hood large, cordate, basally narrowed. Lateral plates small and lunulate. Tegmen V-shaped. Strut elongate, not close to foramen. Flagellum was not observed. Spiculum (fig. 7c) V-shaped and somewhat asymmetrical.

Female. The fifth abdominal sternum with a large, irregular, dense, patch of setae on central elevation.

Biology. Frost, 1924, reported that *Chalepus notatus* (Olivier) occurs on *Tephrosia virginiana* from Fla., Va., and Wash., D. C.

Variation. Size variation is as follows: total length: males 6.0-6.1 mm., females 6.2-7.0 mm.; elytral length: males 4.7-4-8 mm., females 5.1-5.4 mm.; elytral width: males 2.4-2.5 mm., females 2.6-2.8 mm. The total length of males is less than females, and shows sexual dimorphism of total length.

Distribution. The general distribution of *O. notatus* (Olivier) is indicated on Plate II. This species is known from New Jersey to Mississippi and has been collected from late May to early August, mostly in July.

Specimens Examined. 27: 10 males, 13 females, 4 sex undetermined.. ALABAMA: Mobile Co., Mobile, June, 2 females, (USNM); 2 males, 2?, N. S. Easton; 1?, Liebeck, (MCZ), Grank-Bay, 1 male, 3 females, H. P. Loding, (CAS).. MISSISSIPPI: Jackson Co., Ocean Springs, July 13, 1930, 1 male, H. Dietrich, (CU). Wilkinson Co., Woodville, July 6, 1921, 1 male, C. J. Drake, (UCB). Richton, April 23, 1930, 1 female, H. Dietrich, (CU). No further data: Aug. 9, 1921, 1 female, C. J. Drake, (CAS). NORTH CAROLINA: Currituck Co., Currituck, June 22, 1948, 1?, J. Conner, (UNC). Southern Pines, May 3, 1905, 2 females, A. H. Manee, (USNM). NEW JERSEY: Atlantic Co., Da Costa, 1 male, Van Dyke, (CAS); 1933, 1 female, Wickham, (USNM); 1 female, Bowditch, (MCZ); 3 males, F. A. Eddy, (MCZ). No further data: 1 male, 2 females, (MCZ).

5. Odontota floridanus new species

(Fig. 8, a, b, c; Plate II)

Diagnostic Features. This species resembles *O. notatus* (Olivier) in color and habitus, but can be easily separated from the latter by the presence of the following characteristics:

Mesosternum orange-yellow; frontal carina diamond-shaped; width of eye wider than dorsal interocular distance; outer elytral margin distinctly serrulate. Aedeagogastrale spiculum V-shaped.

Holotype. FLORIDA, Putnam Co., Welaka, May 1-4, 1955, (H. E. and M. A. Evans collectors); male; deposited in the collection of Cornell University, Ithaca, N. Y., Cornell Type No. 4394.

Host Plant. Unknown.

Description of Holotype. Length 5.7 mm.; width 2.4 mm.; oblong. *Head:* length/width ratio, .875. Frontal carina diamond-shaped. Antennae 2.0 mm. long; 2nd segment cylindrical; segments 3-6 subconic; 2nd 1.3 times shorter than 1st; 3rd 1.5 times longer than 4th. Clypeus coarsely tuberculate. Labrum prominent, broader than long. Mandibles slightly robust; apices obtuse; cutting edges are not broad. Eye width equal to the width of clypeus and wider than dorsal interocular space. *Pronotum:* length 1.1 mm.; width 1.8 mm. Lateral margins angulo-subrotundate at middle, narrowing towards apex and obliquely more so towards base. Dorsum regularly convex, with no traces of posterior depression; surface deeply punctate; interstices subcristate, sparsely alutaceous. Medial line well-defined with shallow longitudinal groove. Legs normal; apex of last tarsal segment feebly sulcate between the bases of claws. *Elytra:* length 4.5 mm.; width 2.4 mm. Outer margin distinctly serrulate. Punctures of elytra generally rounded, but distinctly elongate towards apex in 1st and 2nd stria. *Abdomen:* with 5th sternum truncate, feebly emarginate, and hardly perceptible setae on either side of median elevation.

Color. Prothorax orange-yellow, except on dorsum a large, regular, black central spot. Mesosternum and anterior one-fourth metasternum orange-red. Abdominal 5th sternum laterally pale yellow. Legs and elytra entirely black.

Male Genitalia. Aedeagus moderately sclerotized and showing greater curvature from below (fig. 8a). Basal foramen large, slightly smaller than one-fourth the length of aedeagus; strongly convex antero-dorsally, running into a depression at one-fourth from base. Apical orifice large (fig. 8b), lunulate. Apical hood large, cordate, basally narrowed. Lateral plates small and sublunulate. Tegman U-shaped. Strut short, slightly close to foramen. Flagellum was not observed. Spiculum (fig. 8c) V-shaped and symmetrical.

Allotype. Female; same data as holotype, except the date April 18-20, 1955, length 6.2 mm.; width 2.6 mm. Female is somewhat larger than the male. Fifth abdominal sternum with a large, irregular, dense, patch of setae on central elevation.

Paratypes. 41: 19 males, 19 females; 3 sex undetermined. Paratypes are designated from the following localities: FLORIDA: Putnam Co., Welaka, April 18-20, 1955, 1 male, H. E. & M. A. Evans, (type locality), (CU); Crescent City, April, 1908, 1 female, Van Duzee, (CAS). Osceola Co., Kissimmee, 3 males, 1 female, Chas. Palm (AMNH). Duval Co., Jacksonville, 1 female, Liebeck, (MCZ); 1 male, 2 females, 2?, Mrs. A. T. Slosson, (AMNH). Volusia Co., Ormond, 1 male, Mrs. A. T. Slosson, (AMNH); 1 female, F. C. Bowditch, (MCZ); De Leon Sprs., July 5, 1929, 1 female, John George Gehring, (MCZ). St. Johns Co., St. Augustine, Aug. 18, 1932, 1 male, L. Lacey, (AMNH). Sarasota Co., Sarasota, 1 female, John George Gehring, (MCZ). St. Petersburg, April 28, 1908, 1 male, Van Duzee, (USNM). Seminole Co., Sanford, April, 1908, 1 female, 1?, Van Duzee, (USNM). Aug. 4, 1930, 1 female, R. H. Beamer, (UKL). Polk Co., Lakeland, March 26, 1923, 1 male, E. M. Craighead, (USNM). Nassau Co., Hilliard, July 24, 1939, 1 male, D. E. Hardy, (UKL). Palm Beach Co., W. Palm Beach, June 11, 1941, 1 female, L. W. Hepner, (UKL). Hills Co., Tampa, July 20, 1924, 1 female, P. McKinstry, (UKL). Enterprise, 4 males, 2 females, Liebeck, (MCZ); 3 males, D. M. Castle, Van Dyke, (CAS). Estero, May 6-12, 1908, 1 female, Van Duzee, (USNM). Suwannee Spr., Aug. 2-3, 1939, 1 female, Wakullah, July 10, 1939, 1 male, R. H. Beamer, (UKL). No further data: 1 male, F. A. Eddy; 1 female, (MCZ). 2 females, (AMNH).

Biology. Unknown.

Larvae. Unknown.

Variation and Discussion. Size variation is as follows: total length: males 5.7-6.3 mm., females 6.2-6.7 mm.; elytral length: males 4.4-5.0 mm., females 4.8-5.2 mm.; elytral width: males 2.4-2.7 mm., females 2.6-2.8 mm. The total length of males is less than females, and thus shows sexual dimorphism of total length.

The close relationship between *O. floridanus* n. sp. and *O. notatus* (Olivier) is indicated in their similar general appearance, namely the pronotal color, structure of vertex, clypeus, last tarsal segment, elytral color and punctuation. However, the following characters of *floridanus* will facilitate for rapid separation from *notatus:*

Entire mesosternum and one-fourth metasternum orange-yellow; frontal carina diamond-shaped; apices of mandibles obtuse and not broad; width of eye wider than dorsal interocular distance; elytral margins distinctly serrulate. Aedeago-basal foramen large, antero-dorsally strongly convex; tegmen U-shaped; strut short, dorsally triangulate; gastrale spiculum V-shaped and symmetrical.

Distribution. The general distribution of *O. floridanus* n. sp. is indicated on Plate II. This species may be confined to the state of Florida, but none of the locality data is adequate enough to indicate what life zones this species occupies. Some of the above mentioned localities show marshy distribution. It has been collected from late March to middle of August, mostly in July and August.

6. Odontota dorsalis (Thunberg, 1805) New Combination

(Fig. 9, a, b, c; Plate II)

Chalepus dorsalis Thunberg, 1805:282; Gemminger and Harold, 1876:3613; Horn, 1883:290, 296; Hopkins, 1896:248; Chittenden, 1897:22; 1902:70-83; Blatchley, 1910:1227; Leng, 1920:303; Frost, 1924:464; Needham, Frost and Tothill, 1928: 197-199; Poos, 1940:742-745; Wilcox, 1954:472. (Location of type: Museum of Uppsala University, Uppsala.)

Type Locality. Patria vacat.

Hispa scutellaris Olivier, 1808:771; Crotch, 1873:81, (Synonymized); Gemminger and Harold, 1876:3613. (Location of type: Museum National d' Histoire Naturelle, Paris, France.)

Type Locality. Santo Domingo.

Hispa suturalis Harris, 1835:147; Melsheimer, 1853:118, (Synonymized); Crotch, 1873:81; Gemminger and Harold, 1876:3613. (Location of type: The Society of Natural History, Boston, Massachusetts)

Type Locality. "Carolina", U. S. A.

Odontota harrisi Crotch, 1873:80; Horn, 1883:290, 296; Leng, 1920: 303, (Synonymized). (Location of type: in LeConte collection, Museum of Comparative Zoology, Cambridge, Massachusetts.)

Type Locality. Unknown to me.

Odontota dorsalis (Thunberg), Henshaw, 1885:114.

Xenochalepus dorsalis (Thunberg), Weise, 1911 (a):27; 1911 (b):40; Leng, 1920:303; Maulik, 1937:137; Uhmann, 1938:427, 437.

Diagnostic Features. This species resembles *O. horni* in color, size, and shape, but may be readily separated from the latter by the presence of the following characters:

Elytra with an unequal, black sutural stripe becomes gradually broader and extends to apex; outer margin distinctly serrulate; punctures of elytra generally rounded, but distinctly elongate towards apex in 1st and 2nd striae. Clypeus micro-granulose. Pronotal median line well-defined; prosternum black. Apex of last tarsal segment deeply cleft between the bases of claws.

Description of Species. Male. Massachusetts, Beach Bluff, July 19, 1915, H. M. Parshley collector, (CAS).

Length 6.2 mm.; width 2.6 mm.; wedge-shaped. *Head:* length/width ratio, .714; vertex trisulcate; area between ocular and median sulcus finely rugo-punctate. Frontal carina elongate. Antennae 2.0 mm. in length; basal segment incrassate, slightly longer than its width; 2nd cylindrical; 1st and 2nd subequal in length; 3rd slightly obconic, about 1.5 times as long as 2nd; segments 4-6 obconic and each gradually decreasing in length. Clypeus micro-granulose. Labrum longer than broad. Mandibles robust, apices acute, sharp. Eye width equal to the width of clypeus and dorsal interocular distance. *Pronotum:* length 1.0 mm.; width 1.8 mm.; widest medially; lateral margins distinctly subangulate near middle, narrowing anteriorly and obliquely more so posteriorly. Dorsum transversely convex; slightly depressed posteriorly with ante-scutellar transverse ridge. Surface coarsely, deeply, foveo-punctate; punctures generally elongate; interstice shiny, subcristate. Medial line ill-defined. Mesotibia with small, inconspicuous, subapical tooth. Apex of last tarsal segment deeply sulcate between the bases of claws. *Elytra:* length 4.3 mm.; width 2.2 mm.; outer margin serrulate. Punctures of elytra generally rounded, but distinctly elongate towards apex in first two striae. There is a feeble, short, apical carina between 6th and 7th rows of punctures. *Abdomen:* sparsely micro-punctate; 5th sternum apically truncate and in male hardly perceptible setae on either side of median elevation.

Color. Pronotum and elytra yellow, the latter with a black sutural stripe becomes gradually much broader and extends to apex. 5th abdominal sternum bright yellow laterally. Venter and legs black.

Male Genitalia. Aedeagus moderately sclerotized and showing considerable curvature from below. Basal foramen large, equal to one-fourth the length of aedeagus. Anterior portion on lateral view (fig. 9a) broad; rectate anterodorsally and running into a depression at one-third from base. Apical orifice large and V-shaped. Apical hood large, triangulate. Lateral plates large and irregular. Tegmen V-shaped with long truncate parameres. Strut elongate bent upward into the foramen. Flagellum stout, broad, S-shaped, and one-third the length of aedeagus. Spiculum (fig. 9c) V-shaped, asymmetrical.

Female. Females are larger than males. Fifth abdominal sternum with a small, irregular patch of setae on either side of central elevation.

Biology. Relatively more is known about the biotic association of *O. dorsalis* Thunberg than any other species of genus *Odontota.* The following biological data are from published reports and notes in quotation marks are from the literature. A brief historical review on biology and economic importance of *O. dorsalis* is given below.

(1) Fitch, 1865.—first time this insect was reported severely injuring the foliage of black locust at Glen Cove, Long Island, N. Y.

(2) 1880.—an anonymous writer reported this species, under the name *Odontota scutellaris* Olivier, attacking species of oak and elm.

(3) Hopkins, 1896.—reported adults of this leaf miner feeding upon white oak, beech, birch, hawthorn, and apple.

(4) Chittenden, 1897.—reported rearing of this species from larvae found mining the leaves of soybeans.

(5) Chittenden, 1902.—has given the best account of leaf-mining and life-history of *Chalepus dorsalis* Thunb., on black locust.

(6) Houser, 1913.—reported this insect as a pest of apple in Southern Ohio.

(7) Houser, 1918.—reported the severe attack on soybeans in Southern Ohio.

(8) DeLong, 1925.—made the observation of attack on soybeans in Southern Ohio, as follows: "The feeding by this insect is much more severe than any feeding caused by the Mexican bean beetles upon the same crop."

(9) Guyton, 1926.—reported the attack on soybeans in Green Co., Pennsylvania.

(10) Dominick, 1938.—observed large numbers of a new brood of adults of this species feeding on oak.

(11) Poos, 1940.—reported as a pest of soybeans, and mentioned that the "possibility" of two biologically distinct forms might exist on the basis of discriminating food habits, namely the forms feeding on soybeans and black locust.

Chittenden, 1902 on black locust and Poos, 1940 on soybeans have given the best account of leaf-mining and life history of *O. dorsalis* Thunberg, from whom I have borrowed the facts.

"The leaf-mining locust beetle, *C. dorsalis*, is perhaps the species best known, on account of the midsummer damage it does to the leaves of the black locust (*Robinia pseudoacacia*). In case of severe attack the leaves turn brown as if scorched by fire."

The adult beetles make their appearance in early spring as soon as the locust leaves are fully developed. The eggs are laid on the underside of locust leaves in small masses of three to five, glued together, and partially covered with excrement. The first egg of the mass is laid flat on its side and others partly overlap the first one and, therefore, stand obliquely, with one end of each egg touching the leaf surface. A brown spot soon appears on the upper leaf surface.

The larvae on hatching enter the leaf under the protection of the egg mass through a single hole that is made by the larva that hatches first, and all of them occupy one common mine. They consume all the mesophyll within the mine. From two to four days, after having eaten half or more of the first leaf they leave the mine and wander to other leaves and separately make new mines. There are several such changes of habitation, and the damage to the tree is greatly increased by this uneconomical habit. The larval life appears to last about 3 weeks.

Larvae. The larva of *O. dorsalis* is rather unspecialized for a leaf miner. It is slightly depressed and not much narrower behind the prothorax. The second and third segments of the thorax are distinctly wider than the first. Legs are well developed. The body is yellowish-white, with darker sclerotization of head, prothoracic disc, legs and dorsum of anal segment. The abdominal segments are triangularly produced at the sides each into the thin, flat, spine-tipped tooth.

Pupation occurs within the mine and the pupal stage lasts a week or ten days. The adult beetles, emerging break their way out through the thin and brittle epidermis of the leaf. There is apparently a single brood annually northward with more than one in the south.

Variation. Size variation is as follows: total length: males 5.5-6.1 mm., females 6.6-6.8 mm.; elytral length: males 4.5-5.0 mm., females 5.3-5.5 mm.; elytral width: males 2.3-2.6 mm, females 2.9-3.1 mm. The total length of the males studied is considerably less than the length of the females, and thus shows striking sexual dimorphism of total length. Prosternum black, but in some specimens yellow at base and apex. Frontal carina extends as a cristulate between the antennae and joins clypeal base, but in some specimens the carina extends further down and joins clypeal apex.

Distribution. The general distribution of *O. dorsalis* Thunberg is indicated on Plate II. This species is known in the east from southern Canada to Georgia and westward to Illinois. It has been collected from middle of April to late August, mostly in May, June, and July.

Specimens Examined. 365: *CANADA:* ONTARIO: Pelee Island, I-VII-1940, 1, W. J. Brown, (CNC); Ottawa, 20-VI-1949, 1, G. S. Walley, (CNC). *UNITED STATES:* MASSACHUSETTS: Plymouth Co., Duxbury, Aug. 17, 1897, 3, Percy, Gardner, and Bolster. Norfolk Co., Newton, 3, F. C. Bowditch, (MCZ). Hampden Co., Springfield, July 27, 1901, 4, F. Knab, (USNM). Bristol Co., Swansea, Aug. 21, 1943, 1, N. E. Easton, (MCZ). Essex Co., Nahant, July 15-30, 1900, 1, Percy, Gardner, and Bolster, (MCZ). CONNECTICUT: Fairfield Co., New Canaan, June 18, 1956, 1; July 15, 1949, 1; Aug. 14, 1949, 1, M. Statham, (AMNH). RHODE ISLAND: Watch Hill, Aug. 1, 1909, 5, W. Robinson, (USNM). NEW YORK: Kings Co., Rockaway Bch., Aug. 3, 1916, 2, F. A. Sherriff, (CAS). Cherry Valley, July 26, 1948, 22, J. C. Pallister, (AMNH). Suffolk Co., Farmingdale, June 14, 1914, 29, N. D. Morrow, (CU). Tompkins Co., Ithaca, July 13, 1947, 2 (CU). No further data: 6, J. B. Smith, (USNM). PENNSYLVANIA: Allegheny Co., July 2, 1894, 3, (CU); Pittsburgh, June 26, 19, E. A. Dodge, (CAS). Lancaster Co., Lancaster, May 10, 7, (AMNH). Pike Co., Milford, June 9, 1949, 1, M. A. Cazier, (AMNH). Bucks Co., New Hope, May 14, 1949, 1, J. C. Pallister, (AMNH). Monroe Co., Pocono Lake, Aug. 1, 2, Van Dyke, (CAS). Fayette Co., Uniontown, June 21, 3, Van Dyke, (CAS). Hummelstown, July, 1918, 8, Blaisdell, (CAS); Lingletown, July 4, 4, Van Dyke, (CAS); W. Park, 3, Van Dyke, (CAS). Philadelphia Co., Philadelphia, 1, Van Dyke, (CAS); 29, (CU). NEW JERSEY: Ocean Co., Lakewood, May 18, 15, G. D. Bradford, (AMNH); Lebanon State Pk., May 13, 1949, 1, M. Cazier, (AMNH). Mercer Co., Trenton, May 17, 3, H. B. Weise, (AMNH). Burlington Co., Browns Mills, May 14, 1949, 1, M. A. Cazier, (AMNH). Bergen Co., Palisades Park, May 17, 1959, 14, (AMNH). Atlantic Co., Egg Harbor, June 15, 1, W. S. Abbott, (USNM). Monmouth Co., Freehold, July 19, 1926, 11, L. S. Slevin collection, (CAS). Warren Co., Phillipsburg, June 14, 1914, J. W. Green, (CAS). Bergen Co., Alpine, July 20, 1917, 1, (AMNH). Hornerstown, May 14, 1910, 9; Lahaway, May 30, 1916, 3, Chris. E. Olsen, 3; Nutley, July 4, 1, (AMNH). No further data: 7, O. Dietz, (CAS). MARYLAND: Anne Arundel Co., Odenton, June 16, 1918, 4, H. Dietrich, (CU). Washington Co., Hagerstown, July 28, 1913, 11, W. S. Abbott, (USNM). Glen Echo, Summer, 1922, 1, J. C. Bridwell, (USNM); Woltville, May 3, 1913, 6, W. S. Abbott, (USNM). Baltimore, June 13, 1909, 8, F. E. Blaisdell, (CAS). DISTRICT OF COLUMBIA: Washington, July 22, 1941, 6, L. G. Baumhoger, (USNM); 6, Banks, (MCZ). VIRGINIA: Norfolk Co., May 11, 1928, 1, G. E. Gould, (UKL). Fauquier Co., Warrenton, June 5, 1928, 5, L. C. Woodruff, (UKL). Nelson Co., July 1, 1913, 12, W. Robinson, (CAS). Fairfax Co., Vienna, May 20, 1912, 1, W. S. Abbott, (USNM). Cape Charles, May 4, 1924, 10, F. R. Mason, (CAS). Buffalo Ck., July 5, 1927, 5, (CU). NORTH CAROLINA: Haywood Co., Waynesville, April 30, 1952, 1, W. A. Stephen, (UNC). Alleghany Co., Sparta, Aug. 15, 1945, 6, (UNC). Wake Co., Raleigh, July 9, 1929, 2, T. B. Mitchell, (UNC). SOUTH CAROLINA: No further data: 4, Liebeck, (MCZ). GEORGIA: Fulton Co., Atlanta, April 14, 1905, 1, (CU). WEST VIRGINIA: Harrison Co., Fairmont, July 22, 1927, 10, L. S. Slevin collection, (CAS). KENTUCKY: No further data: 4, (MCZ). TEN-

NESSEE: Smoky Mts., Greenbrier, June 15, 1939, 12, O. Park, (CNHM). Burnt Mt., July 9, 1941, 1, A. C. Frederick, (CU); Clingman's Do. Gt., Smoky Mts. N. Park, June 12, 1947, 1, M. A. Dietrich, (CU). MICHIGAN: Washtenaw Co., Saginaw Forest, May 23, 1950, 1, E. B. Hayden, (UKL). ILLINOIS: Mason Co., Havana, Aug. 14, 1907, 1, (USNM).

7. Odontota horni Smith, 1885

(Fig. 10, a, b, c; Plate II)

Odontota horni Smith, 1885:94; Chittenden, 1902:85. (Location of types: United States National Museum, Washington, D. C.; and one specimen in Julich's Collection in American Museum of Natural History, New York.)

Type Locality. Massachusetts, U. S. A.

Chalepus smithi Donckier, 1899:592; Weise, 1911 (c):174, (Synonymized).

Type Locality. Unknown to me.

Chalepus horni (Smith), Blatchley, 1910:1226-1227; Frost, 1924:464; Wilcox, 1954:472.

Xenochalepus horni (Smith), Weise, 1911 (a):27; 1911 (b):40; Leng, 1920:303; Uhmann, 1931:220; 1938:428; 1957:103; 1964:422.

Diagnostic Features. This species bears a deceptive resemblance to *O. dorsalis* but it may be separated from the latter by the following characters:

Elytra with a narrow, equal, blackish sutural vitta, reaching three-fourths to apex; outer margin not serrulate; punctures uniform. Clypeus coarsely tuberculate. Pronotal median line well-defined; prosternum yellow. Apex of last tarsal segment feebly sulcate between the bases of claws.

Description of Species. Male. Virginia, Glencarlyn, May 30, 1906. F. Knab collector, (USNM).

Length 6.5 mm.; width 2.7 mm.; oblong. *Head:* length/width ratio, .75; vertex trisulcate; sulci close to eyes narrow, short, and deep; the median one broad and shallow. Frontal carina diamond-shaped. Antennae 2.1 mm. in length; 1st segment rotullate at base; segments 2-6 slightly obconic; 2nd slightly smaller than 1st; 3rd about 1.5 times as long as 4th. Clypeus coarsely and irregularly tuberculate. Labrum broader than long; apex arcuato-emarginate. Mandibles robust, apical tooth obtuse. Eye transversely wider than clypeus and narrower than dorsal interocular space. *Pronotum:* length 1.0 mm.; width 2.1 mm.; lateral margins distinctly subangulate near middle, obliquely narrowing anteriorly and more so posteriorly; dorsum regularly convex with absence of posterior depression; surface coarsely, densely foveo-punctate; interstice subcristate, alutaceous. Medial line well-defined with a distinct impressed longitudinal groove. Meso-tibiae of both males and females with a small, subapical, triangular tooth. Apex of last tarsal segment feebly sulcate between the bases of claws. *Elytra:* length 4.5 mm.; width 2.5 mm.; outer margin not serrulate. Punctures generally rounded and uniform. Surface of costae microscopically punctate. *Abdomen:* sparsely micropunctate; 5th sternum apically truncate and with hardly perceptible setae on either side of median elevation.

Color. Prothorax and elytra scarlet red, the latter with a blackish sutural line, narrowing and reaching three-fourths to apex. Abdominal 5th sternum bright yellow laterally.

Male Genitalia. Aedeagus heavily sclerotized and showing considerable curvature from below (fig. 10a). Basal foramen small, equal to one-fifth the length of aedeagus; concave antero-dorsally, post-dorsally convex, running into depression at one-fifth from base. Apical orifice small (fig. 10b), U-shaped. Lateral plates small and lunular. Tegman U-shaped; parameres long, apex obtuse. Strut long, close to foramen, dorsally keeled but not triangulate. Flagellum was not observed. Spiculum U-shaped (fig. 10c), symmetrical.

Female. The 5th abdominal sternum with a small, irregular patch of setae on central elevation.

Biology. "The late Mr. J. C. Bridwell has reared some specimens from the mining leaves of "beggar louse," *Meibomia rigida* Elliott, on July 20, 1940. The record by Blatchley, 1910:1227, of its occurrence on the "hog peanut," *Falcata comosa* L. is probably erroneous, as is also the common belief that the species is rare. Mr. Bridwell's experience with *horni* on its wild hostplants shows this species to be locally abundant."—Unpublished data from H. S. Barber.

Frost, 1924:464, has reported that *Chalepus horni* Smith, occurs on *Cracca virginiana* L. from New Jersey.

Larvae. Unknown.

Variation. Size variation is as follows: total length: males 5.5-6.4 mm., females 6.5-7.0 mm.; elytral length: males 4.3-4.8 mm., females 5.0-5.6 mm.; elytral width: males 2.2-2.7 mm., females 2.7-3.0 mm. The total length of the males studied is considerably less than the length of the females, and thus shows striking sexual dimorphism of total length.

Mesotibia of males and females with a small subapical, triangular tooth, in some specimens the subapical tooth is absent. Pronotum entirely scarlet red, but in some specimens there is a small black spot or small vitta on median line. Pronotum densely foveo-punctate, interstices cristate; but in some specimens the surface is not densely foveo-punctate and the interstices are subcristate.

Distribution. The general distribution of *O. horni* Smith is indicated on Plate II. This species is known from Massachusetts southward to Texas and westward to Nebraska. It has been collected from middle of April to early October, mostly in June and July.

Specimens Examined. 80: 32 males; 48 females. MASSACHUSETTS: Forest Hills, 1 male, 1 female, F. A. Eddy, (MCZ). NEW JERSEY: Atlantic Co., Da Costa, July 26, 2 males, 1 female, F. C. Bowditch, (MCZ); 1 male, 1 female, F. A. Eddy, (MCZ); June 24, 2 females, Liebeck, (MCZ); July 19, 2 males, (UKL); July 4, 1 female, Chas. Palm, (AMNH); 1933, 1 female, Wickham; July 19, 1 male, Hubbard and Schwarz; 1 female, F. K. Knab, (USNM); 1 male, Van Dyke; 1 male, R. Hopping, (CAS). DISTRICT OF COLUMBIA: Washington, May 20, 1 female, Chittenden, (USNM). VIRGINIA: Glencarlyn, June 18, 1913, 1 male, E. Shoemaker, (CAS); May 30, 1 female, Banks, (MCZ); May 30, 1906, 2 males, 1 female, F. Knab, (USNM). Falls Church, May 9, 2 males, Banks, (MCZ). Fairfax Co., Vienna, July 7, 1940, 1 male, July, 1942, 2 males, 8 females, J. C. Bridwell, (USNM). NORTH CAROLINA: No further data: 1 male, Chittenden, (USNM). SOUTH CAROLINA: No further data: 1 female, (MCZ). GEORGIA: Richmond Co., Ft. Gordon, April 20, 1958, 1 female, R. R. Snelling, (UCB). ALABAMA: Randolph Co., Wadley, 1 female, H. H. Smith, (USNM). MISSISSIPPI: Tishomingo Co., Belmont, July 6, 1921, 1 female, C. J. Drake, (UCB). Dennis, July 6, 1921, 1 male, C. J. Drake, (CAS). LOUISIANA: St. Tammany Co., Covington, June 12, 1951, 1 male, Beamer, (UKL). Sabine Co., Many, June 16, 1948, 2 females, B. T. McDermott, (UKL). Longville, June 17, 1948, 2 females, H. W. Crowder, (UKL). July 16, 1907, 1 male, 2 females, F. H. Shoemaker, (USNM); June 13, 1908, 1 male, 1 female, (USNM); 2 males, 3 females, (CAS); 1 female, (CNHM); 1 male, 2 females, (AMNH); May 13, 1909, 9 males, 7 females, (CAS); Oct. 10, 1932, 1 male, (CAS). ARKANSAS: Sevier Co., DeQueen, June 16, 1948, 1 female, L. D. Beamer, (UKL); 1 male, B. T. McDermott, (UKL). TEXAS: Harris Co., 2 females, R. Oeriel, (USNM). Fayette Co., Flatonia, July 30, 1 female, J. W. Green, (CAS). No further data: 3 females, F. A. Eddy, (MCZ). KANSAS: No further data: 1 female, (USNM). NEBRASKA: Otee Co., Nebraska City, 1 female, Wickham, (CAS). ILLINOIS: No further data: 1 male, 1 female, H. Soltan, (USNM). OKLAHOMA: Atoka, June 13, 1915, 1 female, Wickham, (USNM); INDIANA: Hessville, Sept. 9, 1913, 1 female, A. B. Wolcott, (USNM). IOWA: Council Bluffs, June 10, 1906, 4 females, F. H. Shoemaker, (CAS).

Acknowledgements

This work was carried out under the direction of Dr. Ross H. Arnett, Jr., formerly Professor of Biology, Catholic University of America, to whom the writer is indebted for guidance, constant encouragement and aid throughout this study. My sincere thanks to Doctors L. D. Miller, and R. A. Davidson, Biology Department, Catholic University, for reading the manuscript.

I wish also to express appreciation to the authorities and individuals of the following institutions for the loan of specimens for this study. The letters in parentheses indicate the abbreviations used for these institutions throughout this work. American Museum of Natural History, (AMNH), Dr. J. G. Rozen and Mrs. P. Vaurie; California Academy of Science, (CAS), Mr. H. B. Leech; Canada National Collection, (CNC), Mr. W. J. Brown; Chicago Natural History Museum, (CNHM), Dr. R. L. Wenzel; Cornell University, (CU), Dr. L. L. Pechuman; Museum of Comparative Zoology, (MCZ), Dr. J. F. Lawrence; University of California at Berkeley, (UCB), Dr. Ray F. Smith; University of Kansas, (UKL), Dr. G. W. Byers; University of North Carolina, (UNC), Dr. D. A. Young, Jr.; United States National Museum, (USNM), Mr. O. L. Cartwright, Mr. G. Vogt and Dr. R. E. White. The data on biology reported here are from the unpublished notes from the late H. S. Barber's file and are acknowledged in the text.

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Book Review

Curculionidae Subfamily Apioninae of North and Central America with Reviews of The World Genera of Apioninae and World Subgenera of Apion Herbst (Coleoptera). By David A. Kissinger, 1968, Taxonomic Publications, So. Lancaster, Mass., 559 pages, $20.00, cloth.

In this volume Kissinger presents a definitive study of the weevil subfamily Apioninae. 221 pages are devoted to illustrations, graphs, and maps, there being more than 2700 individual illustrations. In addition to the principal material on the North and Central America members of the genus Apion, the world genera of Apioninae (30) are reviewed with a key to them. Also four new genera are described.

To anyone who has studied it or has tried to identify its members, the genus Apion at once seems to be a difficult and large one composed of similar forms. Kissinger's detailed work should make identification of specimens much easier because for each of the 317 North and Central American species he describes and illustrates significant external characteristics along with the male genitalia. Also detailed distribution records are given for each species as well as maps for many. Biological data are also presented for the various species.

Taxonomically, this is a major work, the type of which is greatly needed. This excellent monograph should be a must for anyone interested in the identification of beetles. N.M.D.

Anomalous Antennae in the Cantharidae (Coleoptera)[1]

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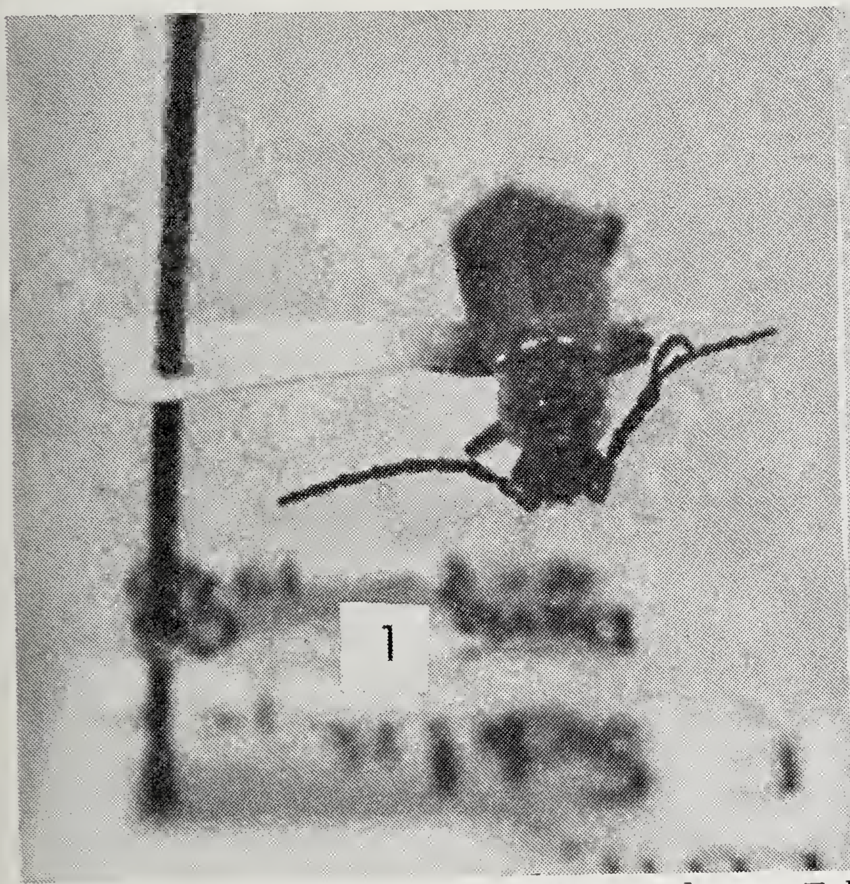
The normal antennae of most of the genera of the Cantharidae in North America are filiform with all but the basal three segments similar in size and shape.

There is, in the collection of the University of California at Davis, California, a specimen of *Podabrus ambiguus* Fall in which the left antenna is grossly misshapen (fig. 1). The fourth and fifth segments are noticeably thicker than the same segments on the right antenna. The sixth segment is vastly enlarged and podiform. Arising from the heel of the foot-shaped segment is an antennule of four malformed segments, the basal one of which is triangular, the rest filiform but contorted. From the toe of the foot-shaped sixth segment arises the nearly normal apical five segments. This specimen was collected at Davis, California, April 3, 1947 by E. Schlinger.

In the collection of the California Department of Agriculture in Sacramento, is a male of *Cantharis americana* Pic in which the right antenna is somewhat similarly split. The sixth and seventh segments are fused and apically expanded into a large, somewhat compressed, cone. Two antennules arise from the distal margin of this cone, each composed of four moderately normal segments. This specimen was collected at Rutherford, Napa County, California, July 20, 1959 by T. R. Haig.



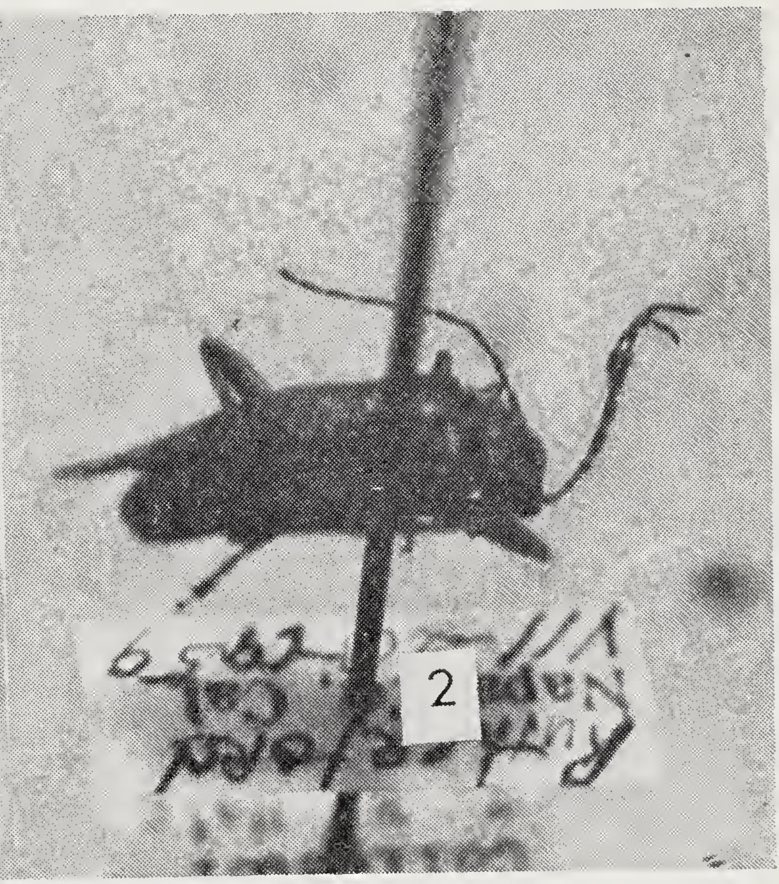


Figure 1. *Podabrus ambiguus* Fall with anomalous left antenna.
Figure 2. *Cantharis americana* Pic with anomalous right antenna.

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[1] This study was supported by National Science Foundation grant No. GB-6283X.

Anomalous antennae such as these seem to be very scarce in the Cantharidae, these two examples being the only ones noticed out of thousands of specimens examined. It would be interesting to know of similar findings in other groups of beetles.

I would like to express my appreciation to R. O. Schuster and T. N. Seeno for the loan of the Cantharid sections of the collections under their control, in which these specimens were found, and to my son, William M. Fender, for photographing the specimens.

Biological and Taxonomic Notes on *Brachyogmus ornatus*, with Descriptions of Larval and Pupal Stages (Coleoptera: Curculionidae)[1]

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The weevil genus *Brachyogmus* Linell and its only included species, *Brachyogmus ornatus* Linell, were originally described in 1897 from material collected in California. The few subsequent references to these taxa in the literature consist mostly of their inclusion in catalogues (Leng, 1920; Schenkling and Marshall, 1934) and in a generic key (Kissinger, 1964). Tanner (1966) discussed the species in connection with a study of the weevils of the Nevada Test Site. Observations on the biology of *Brachyogmus ornatus*, descriptions and illustrations of the larval and pupal stages, and a review of the taxonomic relationships of the species are included in the present paper.

Biology

Tanner (1966) published the first host record for *Brachyogmus ornatus*, stating that the species "breeds in the flowers and seeds" of *Lycium pallidum* Miers. in Nevada. Label data indicate that adults of the species have also been collected on additional species of *Lycium* in California and Arizona. My first attempt to collect the species, mainly for the purpose of obtaining the immature stages, occurred during August, 1965 in the vicinity of Estancia, New Mexico. A few adult weevils were beaten from plants of *Lycium pallidum*, but the immature stages were not found at that time. The plants were mostly in a vegetative stage of growth, with a few mummified flowers being present. Some of these flowers had exit holes and larval feeding cavities suggestive of previous weevil infestations.

The same area was revisited on July 11, 1967, at which time the plants were profusely blooming and fruiting. Adults, mature larvae, and pupae of *B. ornatus* were collected in abundance. Mature larvae occurred within closed flowers feeding usually on the bases of the stamens and on the ovary. Some larvae apparently feed entirely upon the anthers, while others consume all structures of the flowers except the corollas. The petals of each infested flower are tightly and neatly folded together at their apices, thus providing an enclosed chamber in which the larva develops. Infested flowers are easily detected because the closed petals form a clavate corolla tube which contrasts conspicuously with the normal trumpet-shaped one. Only one larva was found in each flower. Although no flower buds were seen on the plants at the time observations were made, the advanced stages of the larvae feeding in the flowers indicates that the eggs are possibly deposited in the buds and larval feeding continues after flowering takes place. Apparently the damage caused by the feeding of the young larvae in the buds is not sufficient to prevent completion of the flowering process. No evidence was found of larvae developing in the seeds as mentioned by Tanner (1966).

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Pupation occurs in the larval feeding cavity and the adult weevil emerges through a hole in the side of the corolla tube. The pupal stage of the few specimens observed required approximately 6 days.

The weevil larvae were parasitized by a pteromalid wasp, *Heterolaccus hunteri* (Crawford)[2]. This is a common weevil parasite which is known to attack several species of *Anthonomus,* as well as species of two other anthonomine genera, *Tachypterellus* and *Smicraulax,* and also members of some other curculionid and bruchid genera (Mueseback, *et al.* 1951; Krombein, 1958). Although few specimens of the parasites were reared, evidence that the weevil is heavily parasitized is indicated by the fact that parasite emergence holes in the corollas were numerous and several weevil larvae were found dead in their feeding cavities.

Hosts and Distribution

The observations of Tanner (1966) and those presented here establish *Lycium pallidum* as a true host of *Brachyogmus ornatus,* but some other members of this plant genus are undoubtedly also utilized as hosts by the weevil. Adult weevils have been examined which were collected on *Lycium andersoni deserticola* at Desert Springs, Calif., on *Lycium cooperi* near Mojave, Calif., and on *Lycium exertum* near Sells, Ariz. Specimens have also been collected on an undetermined species of *Lycium* in Texas. Hitchcock (1932) states that there are 14 native species of *Lycium* in North America. Most of these occur in the southwestern and western United States, and in northern Mexico.

Additional label data on specimens examined refer to collections on cotton plants and in ground trash bordering a cotton field in the State of Sonora, Mexico. The presence of these weevils on cotton is probably accidental, while their occurrence in ground debris indicates that they may overwinter or survive other unfavorable periods in such places.

The distribution of *B. ornatus* as determined from examined specimens is shown in Figure 9.

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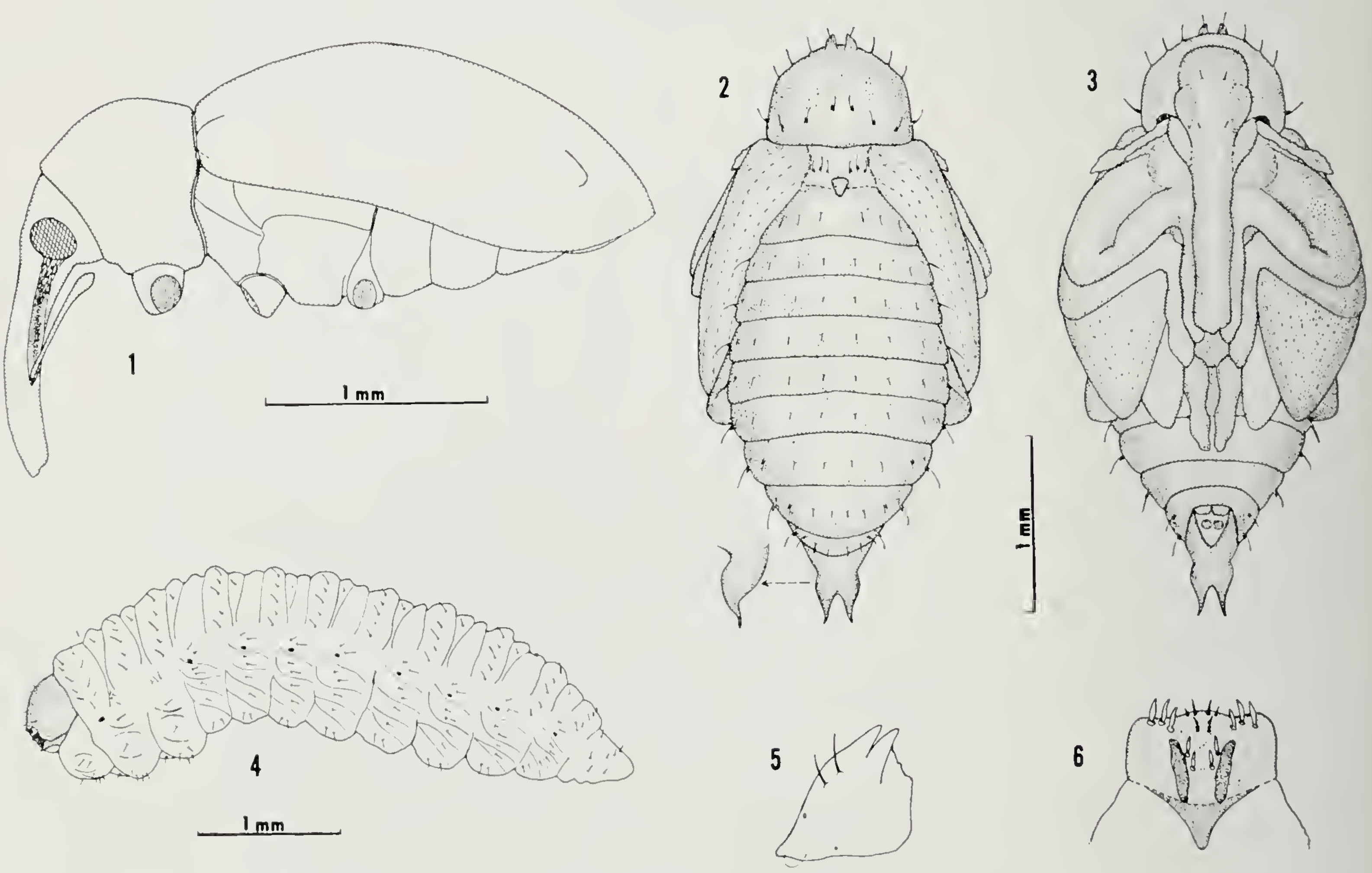
[2] Determined by B. D. Burks, U. S. Department of Agriculture, Washington, D. C.

Descriptions of Larval and Pupal Stages

The terminology of the setae and other structures of the larva follows that proposed by Anderson (1947). Pupal setae are designated by the system published by Burke (1968). The material on which these descriptions are based was taken from flowers of *Lycium pallidum* at Estancia, New Mexico, July 11, 1967, by H. R. Burke. The immature stages were identified by association with reared adults. Specimens are deposited in the collections of Texas A&M University and the U.S. National Museum.

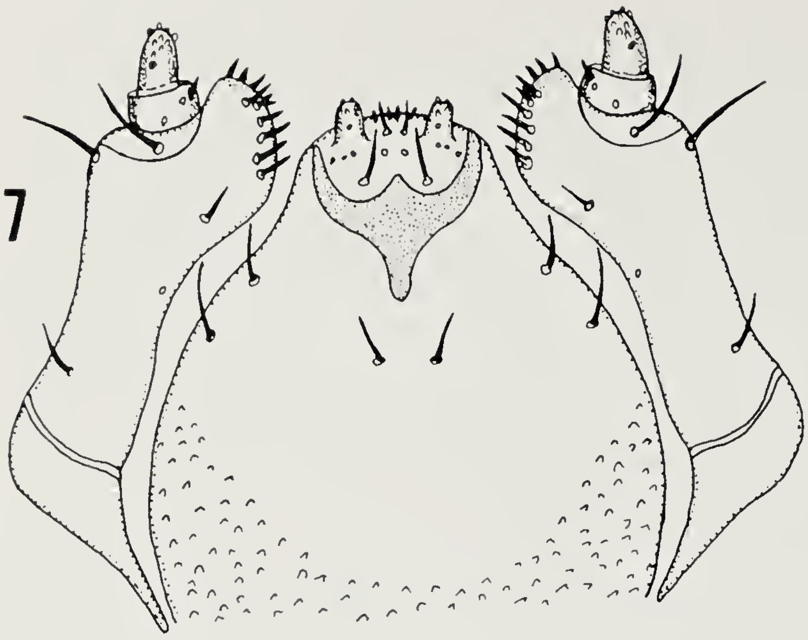
LARVA-BODY-Length, 3.6-4.4 mm. (8 mature larvae). Moderately slender; usually slightly curved (Fig. 4), but sometimes strongly curved; without conspicuous pigmented areas; asperities small, rounded, slightly more dense on thorax and underside of body. HEAD—Free (Fig. 4); mostly light yellowish, sometimes to varying extent suffused with darker color; mandibles dark brown; head capsule distinctly broader than long, width 0.46-0.61 mm. (9 larvae). Frontal sutures wide with irregular margins (Fig. 8); epicranial suture about ½ as long as head capsule; endocarina well defined, approximately ⅗ as long as frons. Setae on head vary from fine to stout; dorsal epicranial setae 1, 2 and 3 about equal in length, setae 4 and 5 slightly longer; frontal setae strongly atten-

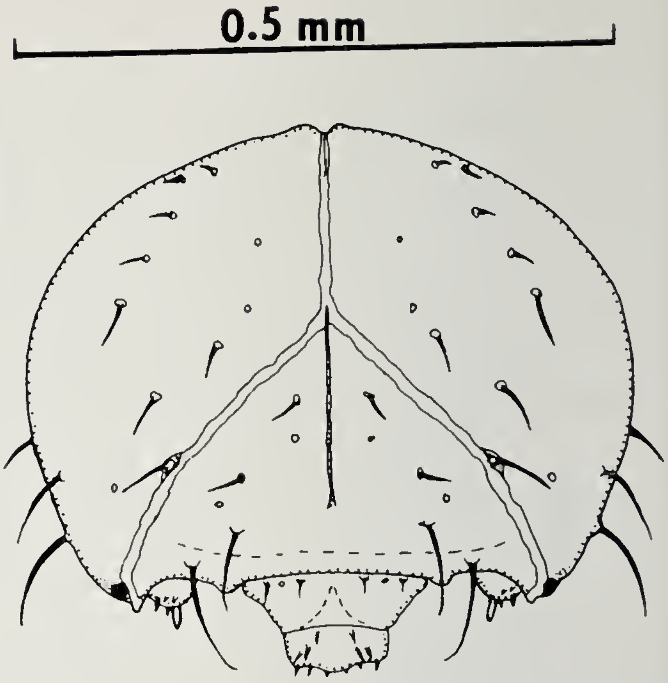


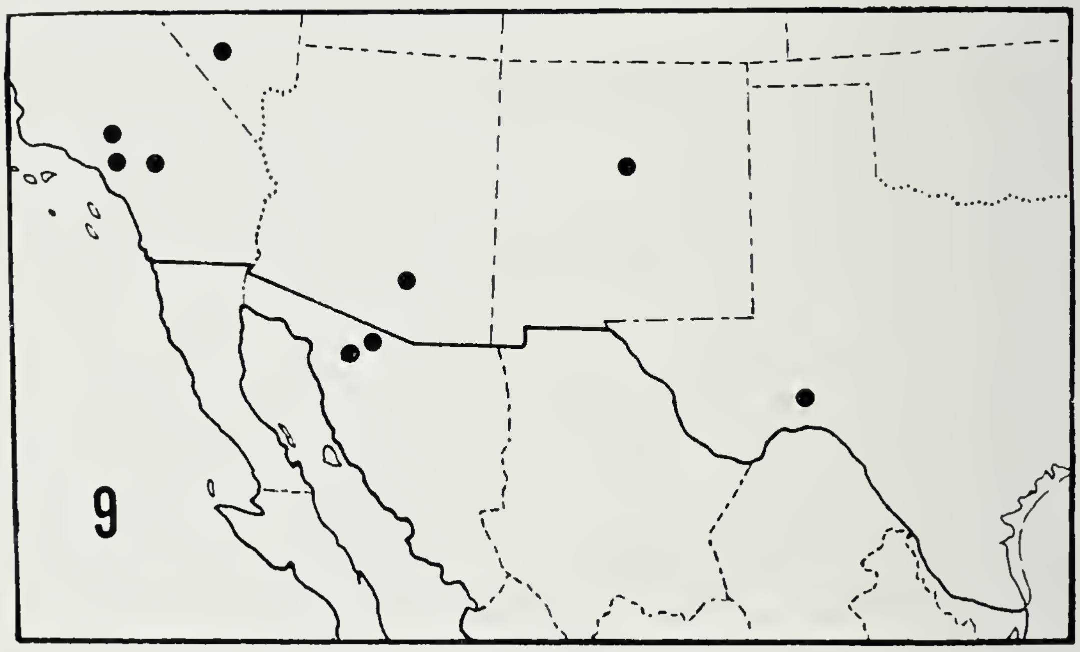
FIGURES 1-6—*Brachyogmus ornatus* Linell. (Figures 1, 2, 3, and 4 each drawn to scale indicated by line; figures 5 and 6 greatly enlarged). FIGURE 1. Lateral view, with scape of antenna in natural position. FIGURE 2. Pupa, dorsal view. FIGURE 3. Pupa, ventral view. FIGURE 4. Larva, lateral view. FIGURE 5. Left mandible of larva. FIGURE 6. Epipharynx of larva.

uate, setae 4 and 5 much longer than others, seta 2 absent; lateral epicranial seta 2 about twice as long as 1. Antenna bearing finger-like elongate, accessory appendage and four short setae, one of which is longer than others. Clypeal setae short, equal in length, each borne on a small, rounded tubercle; sensilla present. Labrum with three pairs of stout, strongly attenuate setae, anterior pair shortest. Epipharynx (Fig. 6) with three pairs of anterolateral setae, three pairs of anteromedian setae, two pairs of median spines; elongate labral rods converging slightly posteriorly; sensory pores arranged in two groups of 2 pores each, located directly behind the posterior-most pair of anteromedian setae. Mandible (Fig. 5) subtriangular, with two elongate teeth at apex; mandibular setae 1 slightly shorter than 2, each borne on small tubercle. Maxilla (Fig. 7) bearing maxillary palpus of two articles, basal article with a short seta near inner margin. Mala of maxilla with six dorsal and five ventral setae. Stipital setae 3 and 4 longest, 2 shortest. Labial palpus consists of a single segment. Premental sclerite with well-defined posterior and lateral projections, anteromedian projection short. Premental setae equal in length to stipital seta 1. Glossa bearing three pairs of setae, posteriormost pair longest. Postmental seta 2 slightly longer than either 1 or 3. THORAX—Pronotum (Fig. 4) bearing 10 moderately long setae on each side. Air tubes of bicameral thoracic spiracle with apparently 6 or 7 annuli. Prodorsum of meso- and metathorax each bearing a moderately long seta on each side of midline. Postdorsum of meso- and metathorax bearing five setae on each side of midline; setae 1, 3 and 5 longer than setae 2 and 4. Meso- and metathorax each with three spiracular setae, two of which are about equal in length, third much shorter. Pleural setae consist of two long ones on prothorax, one of similar length on each of meso- and metathorax. One epipleural seta present on each of meso- and metathorax. Pedal area bearing three long setae and a shorter one on each of the thoracic segments. A fairly long sternal seta present on each side of the midline of each of the three thoracic segments. ABDOMEN—Abdomen (Fig. 4) with eight pairs of bicameral spiracles. Abdominal segments I through VII each with three dorsal folds of which the postdorsum is most prominent. Prodorsum of each segment with one seta on each side of midline; postdorsum of each segment with five setae of which setae 1, 3 and 5 are longer than 2 and 4. Abdominal segments through VIII with two spiracular setae of unequal length on each side; two epipleural setae; one pleural seta; one pedal seta; and two eusternal setae. Abdominal segment IX with several short setae on each side. Anus ventral, subterminal.

PUPA (Figs. 2, 3)—Length—3.1-3.8 mm. (15 pupae). ROSTRUM—Distirostral setae absent. One pair of fine, attenuate basirostral setae separated by distance equal to about twice length of a seta located on rostrum at about level of apices of antennal scape. HEAD—Frontal setae fairly conspicuous, parallel-sided to feebly attenuate, sometimes borne on slight tubercles, separated by distance equal to twice length of a seta. Supraorbital setae lacking. PROTHORAX—Prothoracic depressions well defined. Pronotal setae pale, attenuate, straight to slightly curved. Anteromedian setae each located subapically on anterior face of fairly tall subconical tubercle; tubercles narrowly separated at bases. Three pairs







FIGURES 7-9—*Brachyogmus ornatus* Linell. FIGURE 7. Labium and maxilla of larva, ventral view (greatly enlarged). FIGURE 8. Head of larva, dorsal view, scale indicated. FIGURE 9. Distribution of B. ornatus.

of anterolateral setae of about equal length; series on each side in a straight row; alP_1 usually on summit of low, rounded tubercle, others usually not on tubercles. Posteromedian setae each borne at base on posterior side of a sharply pointed, sclerotized tubercle; tubercles separated by distance either equal to, or slightly to distinctly greater than, width of a tubercle at base. Three pairs of posterolateral setae, each of which is borne at the base of acutely-pointed tubercle; tubercles about equal-sized, series on each side arranged in a slightly curved row. MESONOTUM—Three pairs of straight to slightly curved, attenuate mesonotal setae, msN_1 and msN_2 always located at bases of sharply pointed tubercles, msN_3 either borne at base of similar tubercle or on summit of small, rounded one; msN_2 tubercle usually tallest of the three. METANOTUM—Three pairs of metanotal setae; mtN_2 always located at base of small, pointed tubercle, mtN_1 and mtN_2 usually either not associated with tubercles or are borne at bases of minute ones. ABDOMEN—Three pairs of attenuate, slightly curved discotergal on each of first eight terga; dsT_3 on terga 7 and 8, and sometimes on tergum 6, each borne at base of acutely-pointed tubercle; other discotergal setae not associated with tubercles. Laterotergal setae 1 not associated with tubercles on first four terga, and are located at bases of minute sharply pointed tubercles on following four. Laterotergal setae 2 each about one-half length of tergum on which it is borne; borne at or near base of sharply pointed tubercles which become gradually larger posteriorly. Spiracles small, apparently functional on first five abdominal segments, poorly developed on sixth, absent on seventh and eighth. Abdominal sternal setae lacking. Segment 9 bears a pair of posterolateral processes which are moderately separated at the bases and divergent toward apices; each process curves upward and slightly outward near apex. Segment 9 not bearing setae.

Taxonomic Relationships

Linell (1897) stated that *Brachyogmus* is near the genus *Epimechus,* from which it differs by the "abbreviated scrobes and narrow thorax." The "scrobes" of Linell and most others who have written on the Anthonomini are not true scrobes because the scapes of the antennae do not normally fit into these grooves (Fig. 1); in fact, true scrobes are either absent or poorly defined in the tribe. The grooves which have previously been called "scrobes" in the tribe are here designated as "lateral grooves." The abbreviated appearance of these lateral grooves of *B. ornatus* is caused by scales which fill the shallow basal portion of each groove. This is not an uncommon characteristic in some other anthonomine genera, although the scales in these genera are usually not as closely placed as in *Brachyogmus.* In any event, these characters are of no value for the separation of *Brachyogmus* from other genera of the tribe.

The densely squamose body of *Brachyogmus ornatus* suggests a relationship of this weevil to species of the genus *Epimechus,* as well as to the squamose species of *Anthonomus.* The male genitalia are similar to those of *Anthonomus squamosus* LeConte and its allies, while the simple tarsal claws are shared in common with *Epimechus*; however, *Brachyogmus* is apparently not congeneric with either of these groups. The simple tarsal claws will easily separate adults of *B. ornatus* from all species of *Anthonomus.* One difficulty encountered in separation of *Brachyogmus* from *Epimechus* is that as presently understood the latter contains elements which are clearly not congeneric. Species now placed in *Epimechus* will ultimately have to be distributed within at least two genera. Regardless of this situation, *B. ornatus* is apparently not congeneric with any species now placed in *Epimechus.* The character represented by the elytra sloping gently and evenly from the middle to the apex (viewed from the side as in Fig. 1) is probably the most useful single character for separating *B. ornatus* from *Epimechus.* In fact, this character will distinguish *Brachyogmus* from all other anthonomine genera; the latter have a distinctly defined, and usually strongly sloping, declivity.

The most distinctive adult characters of *Brachyogmus* are: Body densely squamose; elytra in side view gradually sloping from middle to apex; prothorax distinctly narrower than elytra; antennal funicle 6-segmented; tarsal claws simple, widely separated; male median lobe sclerotized dorsally, internal sac with sclerotized structures.

Pupae of *B. ornatus* have no unique character which will distinguish them from pupae of most other genera of the tribe. They trace to the vicinity of *Anthonomus pomorum* Linnaeus, *A. pyri* Kollar and *A. nebulosus* LeConte in my key (Burke, 1968), but judging from adult characters, *B. ornatus* is not at all closely related to these. Pupae of *B. ornatus* possess the pronotal depressions characteristic of the squamose species of the tribe Anthonomini. They differ, however, from the pupae of most known squamose species by having three rather than four pairs of posterolateral pronotal setae. Only three known squamose species, *Anthonomus vestitus* Boheman, *A. squamans* Champion, and *A. testaceosquamosus* Linell ?, have three pairs of posterolateral pronotal setae, and *B. ornatus* is easily distinguished from these by the more widely spaced posterior processes of the ninth abdominal segment.

Larvae of *B. ornatus* differ from those of *Epimechus arenicolor* Fall, (the only species of *Epimechus* for which the larval stage is known), and from larvae of the squamose members of the subgenus *Cnemocyllus* of *Anthonomus* by having one mesothoracic epipleural seta rather than two such setae. *B. ornatus* larvae have only one pleural seta on each of the mesothorax and metathorax, while most of the squamose species of *Anthonomus* (except those of the subgenus *Cnemocyllus*) have two or three pleural setae on each of these thoracic segments.

Analysis of characters of the three developmental stages of *Brachyogmus* appears to indicate that it is most closely related to *Epimechus* and to the species-groups of *Anthonomus* containing squamose species. *Brachyogmus* is, however, distinct enough from these to deserve continued recognition as a genus.

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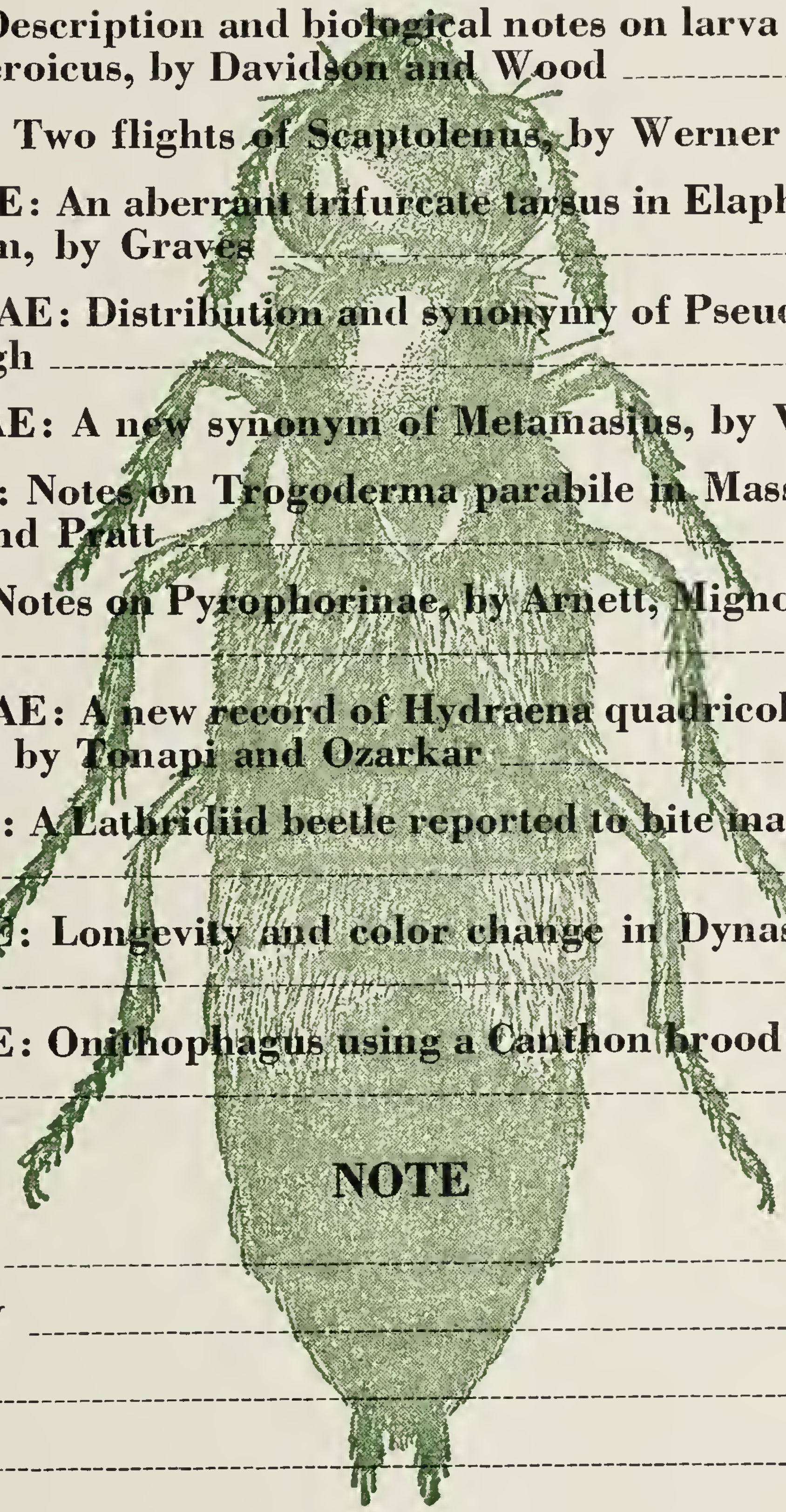

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THE COLEOPTERISTS' BULLETIN
VOLUME 23 MARCH 1969 1

A New Record of *Hydraena quadricollis* Wollaston (Coleoptera: Hydrophilidae) from India.

G. T. TONAPI and V. A. OZARKAR
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As Balfour-Browne (1956) indicated little has been done in studying the Hydrophilidae of India. The authors in attempting to intensify study of Indian water beetles came upon the species described herein. These beetles were observed crawling on decaying twigs that were floating on the surface of water.

Hydraena quadricollis Wollaston[1] was described from Teneriffe and has also been recorded earlier but from the Canary Islands and Cape Verde Islands both on the West coast of Africa in the Atlantic Ocean. *Hydraena nilotica* Rey recorded from Egypt and Tunisia has already been synonymised with *Hydraena quadricollis* Wollaston by d'Orchymont in 1940. This report now further enlarges its recorded range.

Balfour-Browne (1958) has examined different British species of the Hydraenid group and has noted that while some species are brachypterous, others like *Hydraena pygmaea* Waterh. had no wings at all. In still others which he examined in dry mounted condition he noted that the material present was insufficient for making the normal sized wings. The well developed posterior pair of wings and the internally sculptured aedaegophore with each paramere terminally quadruplicated are the features of *Hydraena quadricollis* Wollaston. Fuller information of this species appended with figures is given so that the aquatic coleopterists of other parts of the world will find it easy to identify this small and obscure species (Balfour-Browne 1958, p. 180).

The specimens have been collected from Poona and vicinity in Maharashtra State, the little explored part of this country. The city itself is situated at latitude 18° 30' N and longitude 73° 51' E. The altitude of this place is 1850 feet above sea level and about 63 miles in straight line from west coast. The city lies in the shadow of Western Ghats and surrounded by hills and steep mountains.

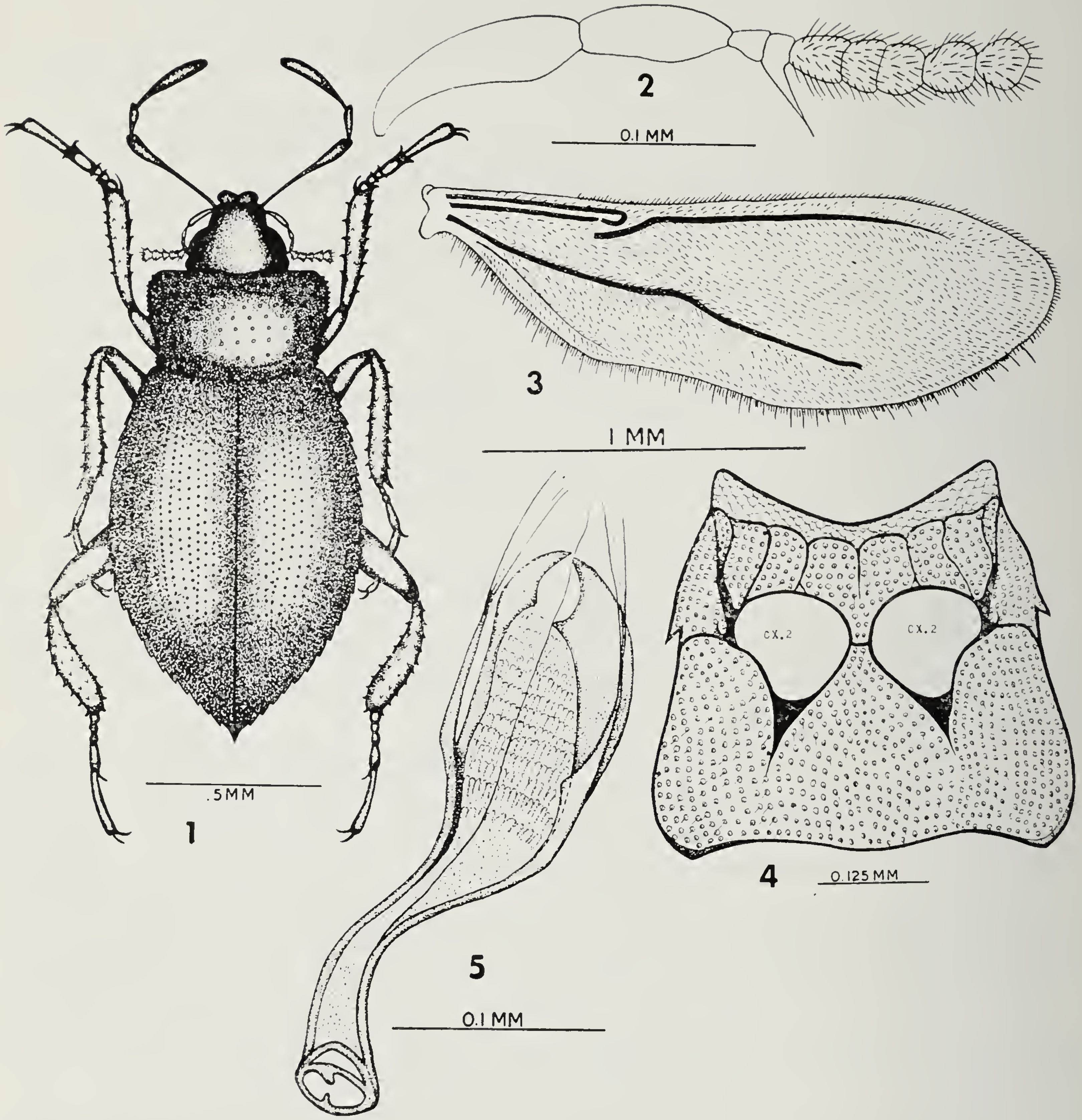
Hydraena quadricollis Wollaston

(Fig. 1).

Rather elongated, ochraceous with head pitchy, maxillary palps and basal

---

[1] This species has ten pairs of spiracles and not eight as reported by Hrbàcek (1949) for *Hydraena ripara* kugel; *Hydraena emarginata* Ray; *Hydraena gracilis* and *Hydraena saga* d'Ochrymont. However this matter will be dealt elsewhere by one of us (V.A.O.)



FIGURES 1-5—Fig. 1. *Hydraena quadricollis* Wollaston. Fig. 2. Antenna. Fig. 3. Posterior Wing. Fig. 4 Meso- and metasternum of *Hydraena quadricollis* Wollaston showing the septacarinate ridging. Cx. 2. Second coxal cavities. Fig. 5. Aedaegophore, Dorsal view showing the curved stiff tube and associated appandages. Figure is drawn with transmitted light and as seen before mounting.

pieces of antennae testaceous, club five segmented, hairy and ochraceous. Elytra and legs testaceous. Underside punctate, setate, and infuscate. No obvious sexual dimorphic characters.

SIZE—1.5 mm.

HEAD—Larger than broad, piceous to pitchy coloration, broadly and rather sparcely punctured in front, closely and coarsely behind and along the lower margins of the eyes. Labrum very deeply emarginate. Maxillary palpi very long, about twice the length of the head, 4 segmented, second longest and larger than third and fourth segments put together. Terminal joint tapered but not very acuminate. Antennae nine segmented with a five-segmented hairy club. Segments three and four quite small, the fourth segment with an acute spine. (Fig. 2).

PRONOTUM—Wider than long, anterior side slightly broader than posterior, a little dilated laternally just before the middle and feebly narrowing towards the base, the hind angles rectangular while the front ones are rounded. Punctures in the form of shallow but broad and sparcely distributed depressions. Borders testaceous with central part rather ochraceous, the lateral border corrugated, i.e. wrinkled into folds of wavy outline and not serrated (See Balfour-Browne 1958). The borders apparently appear serrated but when viewed under high power the corrugations are clearly seen.

ELYTRA—Elytra oblong oval, testaceous with fifteen rows of moderately coarse rather round punctures, the rows converging at the posterior end. Anteriorly curved margins crenulate, lateral margins serrated and apex with a minute emargination. Posterior wings much longer than the abdomen (Length 1.92 mm) and as such this species at least is not brachypterous (Fig. 3).

UNDERSIDE—Meso- and metasternum septacarinate above the second coxal cavities (Fig. 4), broadly, coarsely, and sparely punctured with stiff setae arising from them. The broad and coarse punctures closely placed below the coxal cavities to give the asperate appearance. The setae arising from the punctures point posteriorly and medially while the lateral ones point outwards. The sternal plates also broadly and coarsely punctate and a single posteriorly directed seta takes its origin from each depression. The entire under-surface acts as a hydrofuge, pubescent except for the last two sternal segments which are with relatively few setae.

LEGS—All three pairs testaceous, tibiae not curved, not dilated anywhere along their length, rows of spurs on all sides with a larger spur at the distal end. Tarsal segments of the anterior legs with few hairs.

AEDEAGOPHORE— (Fig. 5). This consists of the median lobe on each side of which are the parameres articulated by the condyles. Each paramere is broad basally while tapered to form distinct flagellae on each side. The main aedeagus body is a stiff and curved tube. The ejaculatory duct running through the tube presumably takes the shape of a flagellum (Lindroth and Palmen, 1956).

HABITAT.

All the specimens were collected from the surface of the aquatic habitats like a pond in the garden, discarded well, or the river sides where these were found to be associated with twigs, decaying plants and other floating objects. These localities are partially shaded by the marginal vegetation. The soil is muddy and at places sandy gravel. The eggs have also been collected and these were found to be inserted in the parts of floating vegetation which had undergone some decay and often rotting.

LOCALITY—S. W. India, Maharashtra State, Poona City. River Mutha: 5 Males and 2 Females V. A. Ozarkar. 29 Sept. 1965. 4 Males in discarded well at Hingane Village 17 Oct. 1965. 10 Males and 10 Females from underside of floating nymphea leaves, pond, law college premises Poona in the middle of August, 1958. (G. T. Tonapi). Two Males and one Female deposited in the collection of the British Museum (Natural History). 2 Females and 2 Males are being sent to the Zoological Survey of India, Calcutta, and a few are in the authors collection at the Department of Zoology, University of Poona, Ganeshkhina, Poona 7.

We are much indebdted to Mr. J. Balfour-Browne (B.M. (N.H.), London) for keen interest, advice, and identification of the specimens. One of us (V.A.O.) is also grateful to the authorities of the University Grant Commission for the financial assistance and to the authorities of the University of Poona for facilities. Thanks are also due to Prof. (Dr.) L. Mulherkar for encouragement.

SUMMARY

Hydraena quadricollis Wollaston is recorded for the first time from the Indian subcontinent. Several males and females were taken floating on water along with twigs and undersurface of aquatic plants from various aquatic habitats of Poona.

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Note

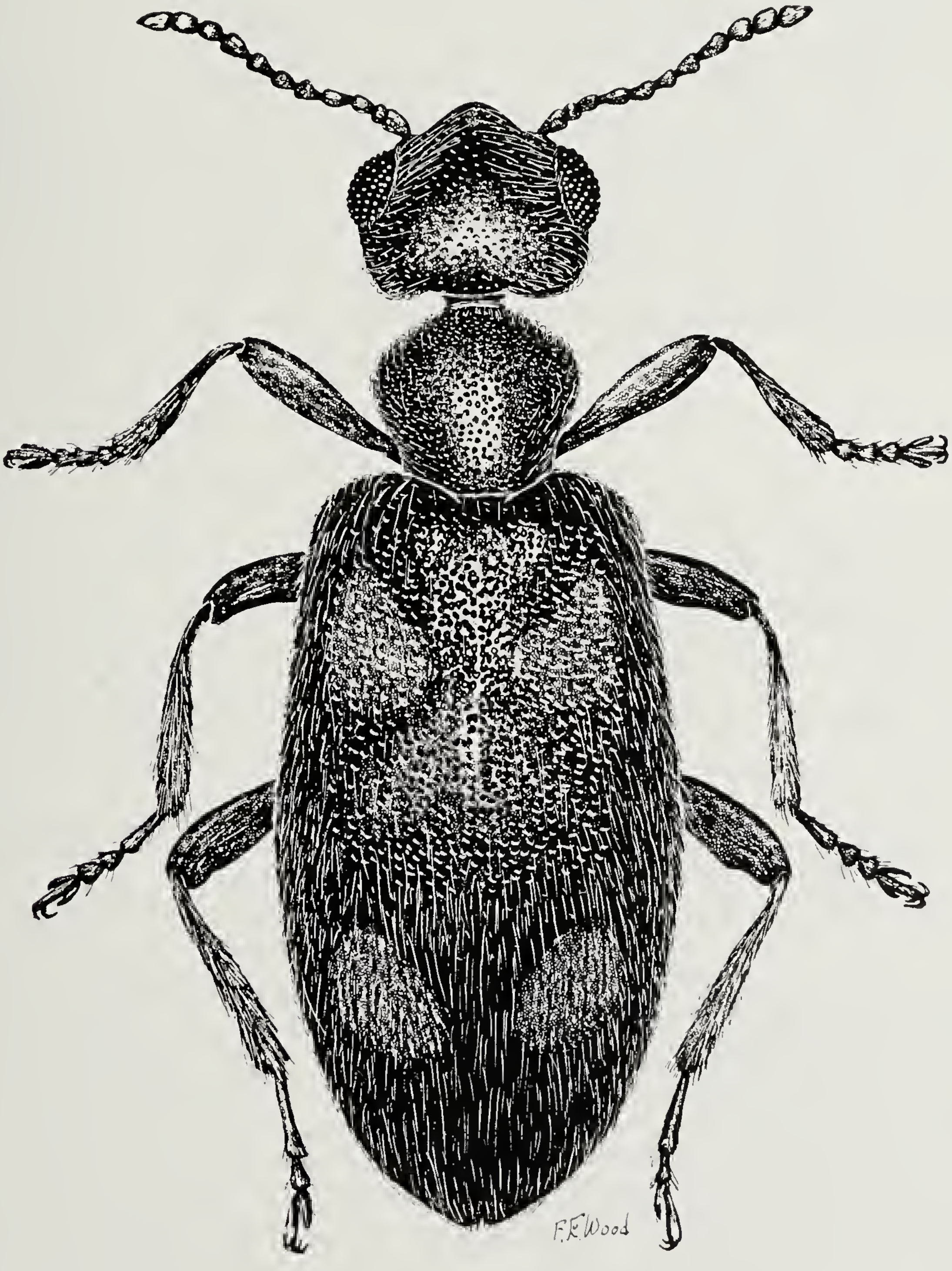
More on the Brendel publication.—The Bulletin of the Scientific Association of Peoria is not as rare as reported (Coleopterists' Bulletin, 22:32) according to T. J. Spilman who supplies the following information. Copies exist at Yale, U. S. Department of Agriculture, John Crear Library in Chicago, University of Illinois, American Academy of Arts and Sciences in Boston, Gray Herbarium Library at Harvard, Museum of Comparative Zoology, New York Botanical Gardens, Academy of Natural Sciences of Philadelphia, American Philosophical Society, and the University of Wisconsin. Part of Brendel's collection, part of the Pselaphidae, is at the Academy of Natural Sciences of Philadelphia and part, *via* Wickham, in the Psota collection at the Field Museum of Natural History in Chicago. Still further information is supplied by John K. Bouseman who writes that the Peoria Scientific Association apparently published only one issue of its *Bulletin,* that in 1887. The Brendel article appears on pages 53 to 63, so it appears that the mimeographed copy in the CSC files donated by Kenneth E. Weisman is a later reproduction of the work. It is of some interest to note that S. A. Forbes' classic essay entitled "The Lake as a microcosm" first appeared in this bulletin. Thirty-eight years later it was reprinted in the Bulletin of the Illinois State Natural History Survey where it must have reached a much larger audience. I thank both of these correspondents for their interest in this subject.—R. H. ARNETT, JR.

Description and Biological Notes on the Larva of *Anthicus heroicus* Casey (Coleoptera: Anthicidae)[1]

JOHN A. DAVIDSON AND FRANCIS E. WOOD
UNIVERSITY OF MARYLAND, COLLEGE PARK

On July 27, 1966, while collecting aquatic beetles in the Bullpasture River two miles north of Williamsville in Highland County, Virginia, numerous dobsonfly egg masses were noticed on large midstream boulders. Close examination revealed some of the egg masses to be off-color. Instead of the normal chalk white they appeared a yellowish to brownish white, with one to several holes perforating the surface of each egg mass.

Further investigation showed the off-color cases contained beetle larvae which were feeding on the dobsonfly eggs and simultaneously creating their own living chamber as they fed. Thirty-seven larvae and 7 adults were collected



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FIGURES 1. *Anthicus heroicus* Casey, adult.

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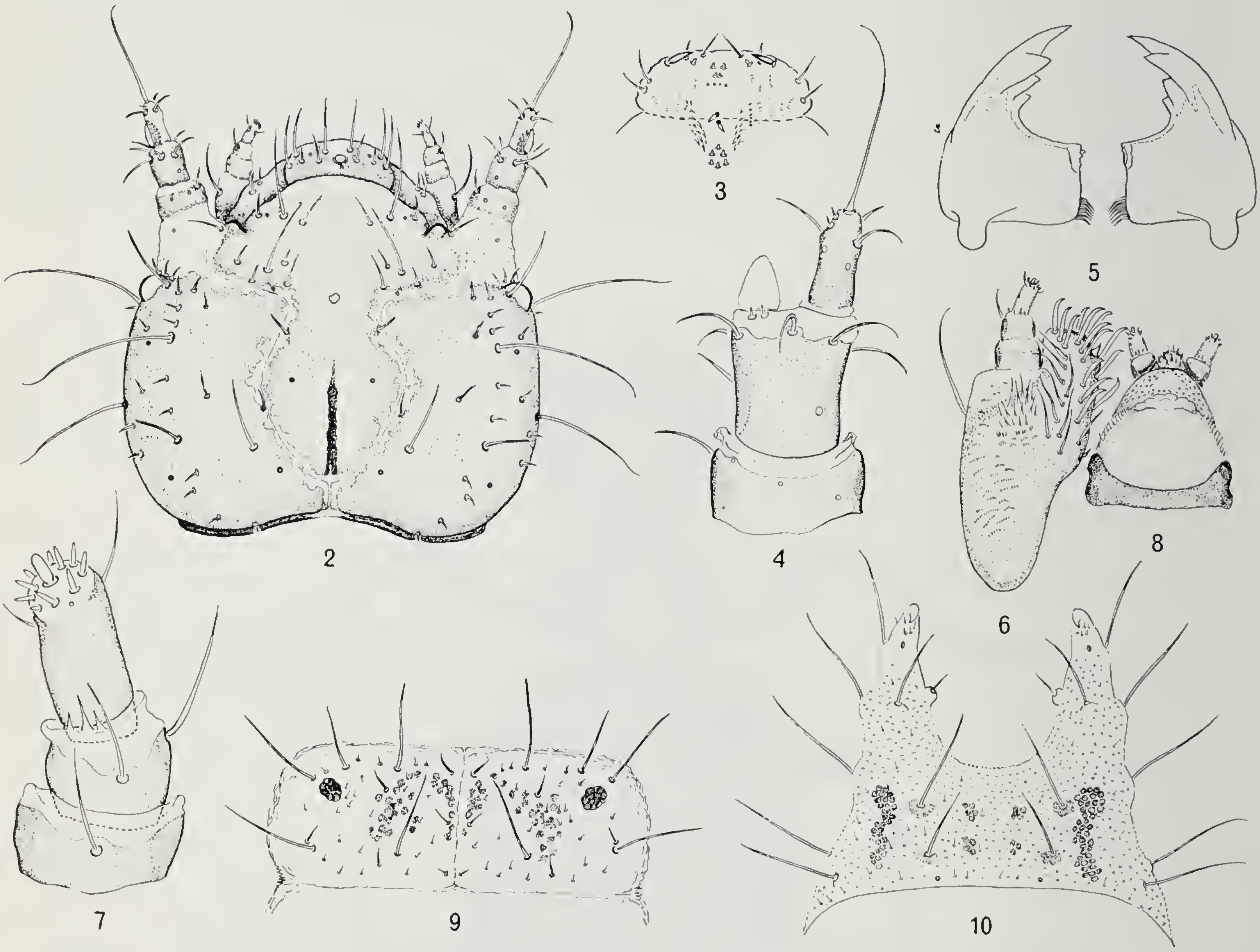
[1] Scientific Article No. A1470, Contribution No. 4103 of the Maryland Agricultural Experiment Station, Department of Entomology.

from 6 cases. Subsequent identification of the adults by Dr. Paul Spangler, Department of Entomology, U.S.N.M., Smithsonian Institution, Washington, D. C., revealed the beetles to be *Anthicus heroicus* Casey 1895. The adult of this species (fig. 1) is one of the few North American *Anthicus* spp. to exceed 4 mm. in length. The color is piceous with paler antennae and legs. Each elytron bears one anterior and one posterior rufous spot as figured. The adult of this species was not figured when described. Werner (1964) revised the North American species of *Anthicus* s. str., and provided outline drawings of the adults with pigmentation patterns. The male genitalia were also figured.



FIGURES 2-10. *Anthicus heroicus* Casey: fig. 2, head, dorsal view; fig. 3, epipharynx; fig. 4, antenna, lateral view; fig. 5, mandible, ventral view; fig. 6, maxilla; fig. 7, maxillary palp; fig. 8, hypopharygeal bracon; fig. 9, prothorax, dorsal view; fig. 10, urogomphi, dorsal view.

The peculiar biology of *A. heroicus* was noted by Howard (1896) who observed that while the larvae feed and develop inside the egg case, they leave the egg case to pupate. Werner (1964) stated that all indications point to most North American spp. of *Anthicus* as micro-scavengers on dead insects.

Peterson (1951) figures a dorsal view of the larva of *Notoxus* which agrees in general outline with *Anthicus*. Böving and Craighead (1930-31) figure several aspects of *Anthicus* spp. from Denmark, and the mandibles, maxilla, hypopharyngeal region, urogomphi, and entire lateral view of *Anthicus heroicus* Casey. Unfortunately, certain aspects are poorly figured. For example, the maxilla is drawn showing both dorsal and ventral setal patterns in what is supposedly a dorsal view. For this reason the above listed structure of the larva of *A. heroicus* is herein refigured, and the epipharynx, antennae, prothorax, and dorsal view of the head are figured for the first time.

Description of Last-Instar Larva of *Anthicus heroicus* Casey

(Figs. 2-10)

Total length 7.2 mm.; greatest width of pronotum 1.0 mm. Color of integument white with sclerotized portions light yellowish brown to brown.

Head quadrangular (fig. 2); 0.8 mm. wide; 0.6 mm. from labroclypeus to occipital foramen. Frontoclypeal suture absent; post labral area nonpigmented. Ecdysial cleavage line present, arising from median occipital region, immediately branching and running anteriorly inscribing a mushroom shaped figure composed of vertex and frontoclypeus, and ending mesad to antennal bases. Cervical sclerites absent. Dorsal surface of cranium faintly reticulate, setaceous, and bearing on each side of midline 1 large and 2 small frontoclypeal setae; 1 large and 4 small frontal setae; 1 isolated small seta bordering the ecdysial cleavage line mesally. Dorsal epicranial area lateral to ecdysial cleavage lines bearing on each side of midline 1 small isolated seta on lateral edge of ecdysial cleavage line; 1 large whiplike seta; 2 large setae; 10-15 small setae mostly of uniform length and constant position. Lateral epicranial region with 1 large whiplike seta and 4-6 small setae on each side of midline.

Labrum subrectangular with 3 large and 2 small dorsal setae on each side of midline; anteriomedial aspect nonpigmented.

Epipharynx (fig. 3) with 8 small marginal setae, 2 stout conical marginal setae, 3 pair of anteriomedial sensillae, followed by a transverse row of 4 sensory pits, 2 small median conical setae, and a posterior circlet of 6 sensillae.

Antennae (fig. 4) 0.3 mm. long, segments 1 and 2 somewhat laterally compressed. Segment 1 two times wider than long, with 1 mesal seta. Segment 2 slightly longer than wide, with 5 setae in a subapical ring. A blunt conelike sensorial process located distally on segment 2 ventrad to segment 3 and accompanied mediolaterally by 2 fine setae. Ultimate segment 4 times longer than wide, with 1 long terminal whiplike seta, 3 small equispaced subapical setae, and 2 fine apical setae ventrad to terminal seta.

Mandible (fig. 5—ventral view) nearly symmetrical, not protruding beyond end of labrum. Each with 2 dorsolateral setae at midlength, 4 scissorial teeth, rather jagged mola, and a penicillus composed of 6 backward projecting setae.

Maxilla (fig. 6) with a truncate mala, bearing dorsally 1 small mesal subapical forward projecting tooth; 3-4 marginal clawlike setae mesally; 7-10 submarginal clawlike setae mesally; 2-3 clawlike subapical setae laterad of midline; a rather irregular median longitudinal row of 8-11 long slender setae. A cluster of 15-20 delicate spines of varying lengths present in the pigmented area at base of palps. One long lateral whiplike seta on anterior margin of pigmented region. Maxillary palps (fig. 7) 3 segmented. Segment 1 about 2 times wider than long, with 1 median ventral seta. Segment 2 about equal in length and width, bearing 1 median ventral and 1 lateral marginal seta and 3 delicate apical spines ventrally. Segment 3 two times longer than wide, bearing one fine seta on apical mesal aspect and one small seta on apical lateral aspect; apex with 10 small peglike setae and one large sensillaform seta.

Hypopharyngeal bracon (fig. 8—dorsal view) boneshaped. Labial palps 2 segmented with 6-8 small apical setae and 1 sensilla. Labium ventrally with 1 pair of small setae on the first prementum, the second prementum, and postmentum respectively.

Prothorax (fig. 9) broader than long, bearing dorsally on 2 lightly sclerotized tergal plates on each side of sagittal line 2 long whiplike anterior submarginal setae; 1 intermediate length anterior submarginal seta; 2 long whiplike posterior submarginal setae; 6 small setae of rather constant position; and about 30 minute randomly positioned setae.

On each side of midline of abdominal terga 3 large posterior submarginal whiplike setae; 1 intermediate length anterior submarginal seta; about 30 small to minute setae randomly positioned.

Urogomphi (fig. 10) 0.25 mm. long; dorsally bearing 2 longitudinal dorsolateral irregular rows of darkly pigmented polygons and 2 median pairs of polygonal pigmented areas basally. Two pairs of long dorsal setae arising basally from lightly pigmented areas. One pair of long dorsal setae located one-fourth the distance from the apex. One pair of small marginal setae born on prominent mesal tubercles. Five pairs of long lateral setae spaced equidistant from each other. Many small setae scattered over the dorsum except for subapical clusters. Derm beaded in appearance except for the smooth upturned hooklike urogomphal apices.

ACKNOWLEDGMENTS

The authors wish to thank Dr. Paul Spangler, U.S.N.M., Washington, D. C. for his helpful suggestions. We also wish to thank Professor Lester E. Harris, Jr., for allowing the use of the facilities of the Columbia Union College Biological Station, Headwaters, Virginia.

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Notice

W. Wittmer has been appointed chief of The Entomology Department, Museum d'Histoire Naturelle, Augustinergasse 2, Basel, Switzerland. He will continue to identify Cantharidae, Drilidae, Phengodidae, and Malachiidae of the world. Small consignments may be sent freely, but for large ones permission should be asked.

NORTH AMERICAN COLEOPTERA FAUNA: NOTES ON PYROPHORINAE, ELATERIADAE[1]

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DEPARTMENT OF ENTOMOLOGY, PURDUE UNIVERSITY, LAFAYETTE, INDIANA 47907

The elaterid subfamily Pyrophorinae needs to be studied in considerable detail for it is certain that there are several unrecognized genera and probably many new species. The following notes have been brought together to aid collectors, and others interested in elaterids, to recognize the group, and to make some classification changes. However, the tribe Conoderini contains a few more genera than indicated here. This will be shown after a revision has been completed.

Pyrophorines may be separated from the other subfamilies by the presence of one or more setae on the claw near the base (these not to be confused with other setae which may be present between the claws at the apex of the tarsal segment). There is little else to define the group at the present time. It is probably one of the most variable of the subfamilies, and in North America, one of the most colorful. The following key will serve to separate all of the genera occuring in North America (including Central America and the West Indies).[5]

KEY TO THE NORTH AMERICAN GENERA OF PYROPHORINAE

1. Antennae received in deep prothoracic sternopleural grooves (Adelocerini) 2
   Antennae not received in prothoracic sternopleural grooves 10
2(1). Antennal grooves nearly as long as prosternopleural sutures 3
   Antennal grooves not over half as long as prosternopleural sutures 9
3(2). Tarsal grooves on propleura only 4
   No tarsal grooves 5
4(3). Broad; pronotum with pronounced median furrow, without tubercles or fovae; tarsal grooves of propleura usually deep and distinctly limited .... **DIPHYAULON**
   Narrow; pronotum without pronounced median furrow; tarsal grooves of propleura short, shallow, punctate, and not distinctly limited .... **ZALEPIA**
5(3). Tarsi simple, segments 1-4 progressively shorter, pronotum without tubercles 6
   Tarsi with segments 3 and 4 dilated beneath; pronotum bituberculate near anterior margin .... **DILOBITARSUS**
6(5). Vestitute fine, not scale-like; pronotum more or less, but evenly convex dorsally; antennae serrate beginning with segment 4 .... **LANELATER**

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[1] Approved by the Agricultural Experiment Station, Purdue University, as Journal paper no. 3642.

[2] Responsible for the key to the genera and the reclassification.

[3] The new species description should be credited to Mignot.

[4] The generic name should be cited with Smith as the author.

[5] Authorities differ as to which countries should be included in North America. Some limit the area to Canada, United States and Mexico, while others include Central America and the West Indies as subdivision. We have decided to follow the usual practice of authors of "Floras" and divide the New World into two sections, South America, including Trinidad and other islands along the northern coast of South America, and North America to include Panamá and all of the countries north, and all of the islands of the West Indies. Greenland is included, but not Iceland.

Vestiture scale-like; pronotum irregular or not dorsally; antennae moniliform, or serrate, if serrate, beginning with segment 3. 7

7(6). Pronotum evenly convex dorsally, without foveae; antennae serrate .... **LEPIDELATER**

Pronotum irregular dorsally, with foveae; antennae serrate or moniliform. 8

8(7). Pronotum bifoveate posteriorly, without median furrow; antennae serrate beginning with segment 3; vestiture scales narrow, not covering entire surface and not forming colored patterns. .... **AULACON**

Pronotum usually bifoveate anteriorly, and sometimes posteriorly, with median furrow at least posteriorly; antennae moniliform; vestiture scales covering entire surface forming colored patterns .... **LACON**

9(2). Grooves only on propleura, and for tarsi only, distinctly limited, deep; scutellum carinate. .... **MERISTHUS**

Tarsal grooves, if present, very shallow and indistinctly limited; scutellum not carinate .... **COLAULON**

10(1). Meso- and metathorax connate between mesocoxae, suture indistinct or absent (Chalcolepidiini) 11

Meso- and metathoracic sutures distinct between mesocoxae. 14

11(10). Prothorax without eye-spots 12

Prothorax with 2 velvety eye-spots. .... **ALAUS**

12(10). Tarsi simple. 13

Tarsi lobed beneath .... **SEMIOTUS**

13(12). Body with small iridescent scales; prosternal mucro elongate. .... **CHALCOLEPIDUS**

Body with long whitish setae; prosternal mucro short. .... **OISTUS**

14(10). Antennae 11-segmented. 18

Antennae appearing or actually 12-segmented (Pyrophorini) 15

15(14). Prothorax with luminous areas near posterior angles; antennae simple. .... **PYROPHORUS**

Prothorax without luminous areas near posterior angles; antennae serrate or flabellate 16

16(15). Antennae serrate. 17

Antennae flabellate .... **HEMIRHIPUS**

17(16). Mesosternal cavity directed vertically inward. .... **ALAMPES**

Mesosternum with raised margin and directed hortizontally backward .... **PYRISCHIUS**

18(14). Tarsi with segment 4 as narrow as 3 21

Tarsi with segment 4 broadened beneath (Conoderini) 19

19(18). Pronotal punctation all of one size. 20

Pronotal punctation of two distinct sizes. .... **HETERODERES**

20(19). Tarsi with segment 4 distinctly lobed beneath. .... **CONODERUS**

Tarsi with segment 4 without ventral lobe but more or less strongly cordate. .... **AEOLUS**

21(18). Antennae with segment 2 small, approximately ½ length of 3 (Pseudomelanactini) .... **PSEUDOMELANACTES**

Antennae with both segments 2 and 3 small, each about ½ length of 4 (Pyrophorini) .... **CHALCOLEPIS**

GENERIC CLASSIFICATION OF NORTH AMERICAN PYROPHORINAE

The classification that follows includes several innovations: 1) the tribe Hemirhipini is placed in synonymy with Pyrophorini; 2) *Alaus* is removed once again from the Hemirhipini and placed in the Chalcolepidiini; 3) a previously unrecognized genus and species is described and recorded from the West Indies; 4) several subgenera have been given generic rank. All references not cited in the bibliography are readily available in one or more of the publications that are listed.

ELATERIDAE

Pyrophorinae

Adelocerini

Lanelater Arnett, 1952, 3 spp., Maryland, Florida, Kansas, Texas, and Arizona (key to spp., Arnett, 1952).
Amaurus LaPorte, 1840 (not Burmeister, 1835).

Diphyaulon Arnett, 1952 [New Category], 4 spp., Eastern United States to Iowa, Texas, New Mexico, Arizona, and Pacific Northwest to western Montana (key to spp., Arnett, 1952).
Lacon subgenus *Diphaulon* Arnett, 1952.

Zalepia Arnett, 1953 [New Category], 6 spp., Northeastern United States, Eastern Canada, Arizona, and West Indies (key to spp., Arnett, 1952).
Lepidotus Stephens, 1830 (not Asso, 1801).
Lepidotus Stephens, 1830, subgenus *Lepidotus sensu stricto.*
Lepidotus Arnett, 1952, subgenus *Lepidotus sensu stricto.*

Aulacon Arnett, 1952 [New Category], 5 spp., Northeastern United States, Florida, Cuba, Arizona, Mexico, Tres Marías Island, Nicaragua, Guatemala, and Panamá (key to species Champion, 1895, and Arnett, 1952).
Lacon subgenus *Aulacon* Arnett, 1952.

Lacon LaPorte, 1836, 10 spp., Northeastern United States to Wisconsin, Wyoming, Nevada, Mexico, Guatemala, and Nicaragua (key to species, Arnett, 1952, and Champion, 1895).
Danosoma Thomson, 1859.
Lepidotus subgenus *Danosoma* Arnett, 1952.

Dilobitarsus Latreille, 1834, 3 spp., Mexico and Nicaragua (key to species, Champion, 1895).

Lepidelater Smith, 1969, 1 sp., *L. misticius* Mignot, 1969, Virgin Islands.

Lepidelater [6]Smith, NEW GENUS

The lateral margins of the elytra are deeply excavated for the reception of the tips of the femora, a feature more pronounced in this genus than most of the Adelocerini. The genus resembles *Lanelater,* but the setae are scale-like. As is noted in the key, the genus combines several of the generic features of the Adelocerini.

Description—Shape elongate, slightly convex, elytral apices evenly rounded; vestiture dense, large, scale-like setae.

Head: antennal segments 3-11 serrate, 2nd segment above ⅓ length of third; mandibles with bifid apices.

Thorax: pronotum slightly broader than long; surface uniformily punctate; shape more or less, but evenly, convex dorsally, without dorsal protuberances or pits; narrowed anteriorly, emarginate; anterior angles projecting; posterior angles acute. Prosternum not compressed, convex in front. Prosternal grooves for the reception of the antennae nearly as long as antennae, reaching almost to the anterior coxae. No tarsal grooves on propleura or metasternum. Scutellum slightly depressed. Tarsal segments simple, segments 1-4 progressively shorter.

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[6] *Lepidos,* scaly; *elater,* drive.

Elytral punctures large, forming even striae; apex of each elytron rounded, lateral margins deeply excavated for reception of apices of femura which extend beyond edges of elytra.

Abdomen: without tarsal grooves, visible sterna subequal.

Type species: *Lepidelater misticius* Mignot, 1969 (Monobasic.)

Lepidelater misticius [7]Mignot, NEW SPECIES

(Figures 1-4)

This moderately large species resembles a *Lanelater* species in general appearance, but the scale-like setae readily distinguish it from any species of that genus.

HOLOTYPE—Male, VIRGIN ISLANDS, St. John November 15, 1966 (in insect trap) USDA Lot 67-2777. [Deposited in USNM collection].

DESCRIPTION OF HOLOTYPE—Shape elongate, slightly convex; length 19.2 mm; color uniformily fuscous; punctation coarse and dense; vestiture dense, large, whitish, recumbent, scale-like setae (fig. 1).

Head: closely and deeply punctate, punctures separated by less than their width; surface with anterior and posterior punctate excavations; length 1.7 mm, width 3.0 mm; interocular distance 1.6 mm; antennae covered with fusco-ferruginous, fine pubescence; antennal segments 3-11 serrate (fig. 2), segment 2 less than half the length of 3; mandibles bifid, directed anteriorly.

Thorax: prothoracic punctures deep, separated by about their width; medial length 5.5 mm; maximum width 5.6 mm; convex dorsally; short medial basal ridge; posterior leteral angles with single stria. Scutellum punctate, with scales.

Elytra 12.0 mm in length, 5.5 mm. wide, rounded apically; each elytron 9-striated, elytral intervals with an irregular row of fine punctures; laterally excavated as described for the genus.

Abdomen: first visible sternum at base of coxae approximately ½ length of second; apical sternum about twice length of fourth.

Male genitalia (fig. 3): trilobed, apices of parameres setose, with external tooth; penis apically acute.

ALLOTYPE—Female, same data as holotype.

Female genitalia: ovipositor with hemisterna acute apically, without styli. The internal organs are poorly preserved, but a distinctive plate in the bursa copulatrix is evident (fig. 4). This has four rows of combs, each row with the median teeth longest, decending laterally to the shortest, and with the internal rows of teeth shorter than those external.

PARATYPES—4 males and 2 females; 1 female same data as holotype, 3 males and 1 female collected from an insect trap on August 17, 1967, St. John, Virgin Islands, one male, Puerto Rico: Isla Verde, in light trap, September 20, 1968.

INDIVIDUAL VARIATION—No evident secondary sexual dimorphism; the following is the range of variation of the type series: total length, 19.1 to 22.0 mm; head length, 1.7 to 2.1 mm, width, 2.7 to 3.2 mm; interocular distance, 1.6 to 2.0 mm; pronotum length, 5.4 to 6.0 mm, width, 5.6 to 6.2 mm; elytra length, 12.0 to 14.0 mm, width 5.5 to 6.0 mm.

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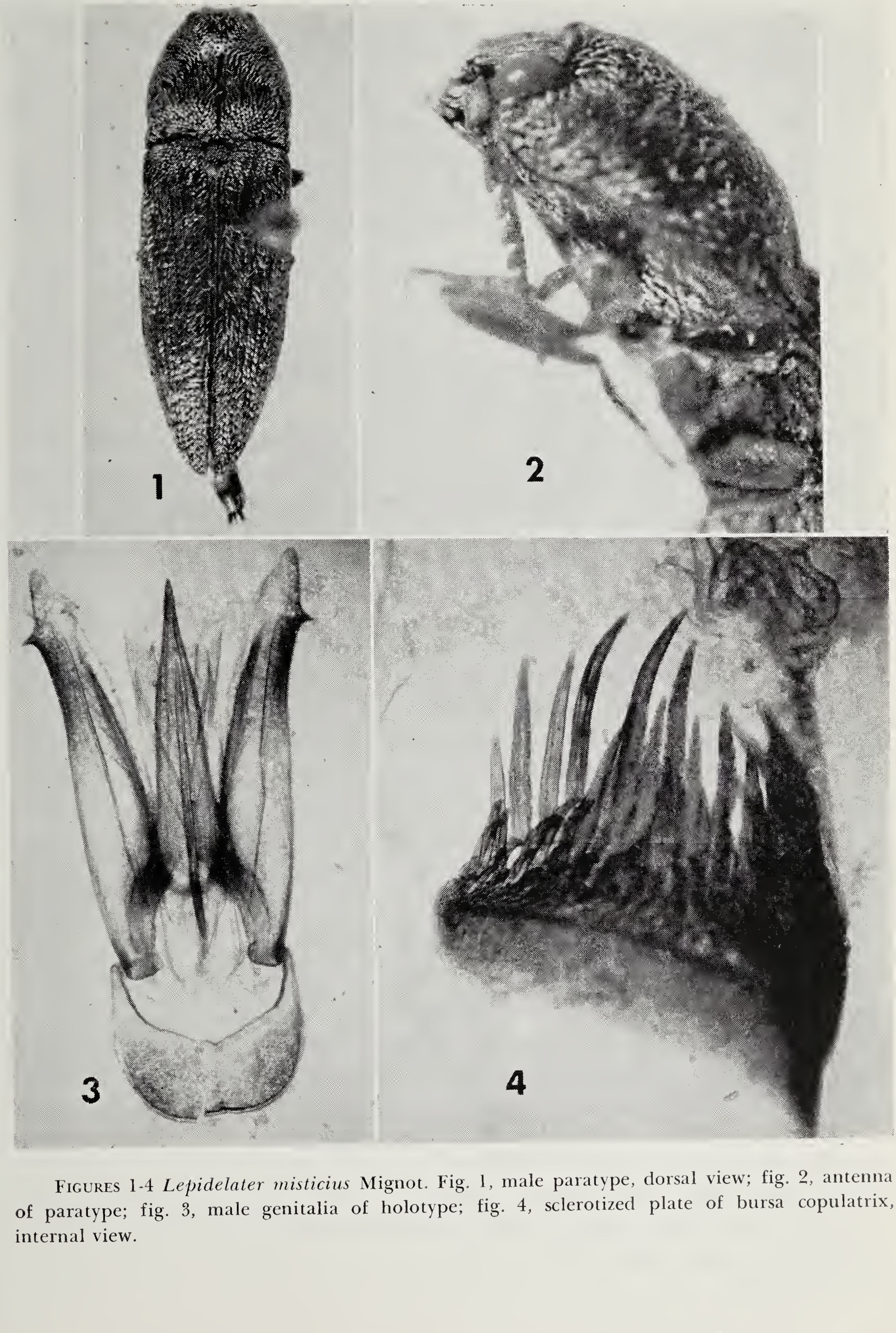
[7] *Misticus,* mongrel.



FIGURES 1-4 *Lepidelater misticius* Mignot. Fig. 1, male paratype, dorsal view; fig. 2, antenna of paratype; fig. 3, male genitalia of holotype; fig. 4, sclerotized plate of bursa copulatrix, internal view.

DISCUSSION—This species has appeared only in Puerto Rico and the Virgin Islands, with only one other species of this group of genera, *Zalepia modesta* (Boisduval), found in the West Indies, and that species is cosmotropical. It seems likely that it occurs elsewhere.

Meristhus Candèze, 1857, 3 spp., southern California, Arizona, Texas, Mexico, Guatemala, and Cuba [also one species widely distributed in the Old World.]

Colaulon Arnett, 1952, 11 spp., southern Florida, north through Alabama, through the Mississippi valley north to Nebraska and Indiana, west to Arizona, and south through Mexico and Central America.

Chalcolepidiini

Alaus Eschscholtz, 1829, 14 spp., eastern United States and Canada, west to Kansas, Oklahoma, Texas, Arizona, southern California, south through Mexico and Central America, and Cuba and Hispanola.

Calais LaPorte, 1836 (not Boisduval, 1836).

Chalcolepidius Eschscholtz, 1829, 56 spp., eastern United States south from Pennsylvania and Ohio, west to Texas, Arizona, and southern California and south throughout Mexico and Central America, one species reported from the West Indies.

Semiotus Eschscholtz, 1829, 10 spp., Mexico, and Central America.

Oistus Candèze, 1857, 5 spp., Oregon, Mexico, and Costa Rica.

Pyrophorini

Pyrophorus Illinger, 1809, 26 spp., Florida, West Indies, Texas, New Mexico, Arizona, Mexico, and Central America.

Alampes Champion, 1895, 2 spp., Nicaragua and Panama.

Pyrischius Hyslop, 1921, 1 sp., *P. haagi* (Champion), Mexico and Guatemala.

Hemirhipus Latreille, 1829, 7 spp., Mexico, Central America, and Cuba.

Pherhimius Fleutaux, 1942, isogenotypic with *Hemirhipus* Latreille.

Chalcolepis Candèze, 1857, 1 sp., *C. luczoti* Candèze, Mexico and Central America.

Pseudomelanactini

Pseudomelanactes Mathieu, 1961, 1 sp., *P. agrypnoides* (Van Dyke), Arizona.

Conoderini[8]

Conoderus Eschscholtz, 1829, 64 spp., Eastern United States, west to Texas, Arizona, and California, south through Mexico and Central America, and the West Indies.

Heteroderes Latreille, 1834, 9 spp., Florida, Alabama, Arizona, California, Mexico, and Cuba, and Puerto Rico.

Aeolus Eschscholtz, 1829, 42 spp., Eastern United States, Arizona, southern California, Mexico, Central America, and the West Indies.

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[8] Several additional, undescribed genera belong here, but it will be some time before this work is completed.

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A Lathridiid Beetle Reported To Bite Man.

CARL T. PARSONS
MANCHESTER DEPOT, VERMONT

In Miami, Florida three members of a family were bitten by beetles most of which were found on the bed sheets, window sills, night table, and walls in the bedroom. A smaller number were noticed on underwear, night clothes, and in the tub after bathing. Only one of the beetles was actually discovered on the skin surface. The bites resulted in pea-sized red papules some of which were capped with vesicles. The patients were not conscious of the bites, but the lesions became itchy in a few hours. Most of the bites were on covered parts of the body.

After the house was fumigated, the greatest concentration of specimens was in a Mexican sewing basket. Forty-one examples were collected by shaking it over a white sheet. Four days after fumigation a few live specimens were found. In the last eight months the family had received a number of visitors and articles from Brazil, Mexico, Japan, and the Philippine Islands.

Dr. A. B. Litterer of Miami submitted specimens to Professor Alexander Petrunkevitch of Yale, from whom the insect was received. The material agrees exactly with H. C. Fall's description of *Belonia unicostata* (Belon) a beetle of the family Lathridiidae. The correct name is now *Eufallia seminivea* Mots.

Evidently this occurrence is the first time any beetle of this family has become important medically. For a complete description consult H. C. Fall, 1899, *Trans. American Ent. Soc.,* 26:142-3, pl. 4, figs. 37, 37a, 37b. An excellent figure can be found on plate 19 of D. Sharp, *Biologia Centralia-Americana, Coleoptera,* vol. 2, part 1, 1902. Fall compared specimens from Crescent City, Florida, with the type. Since specimens have been seen from Alabama: Mobile, and Florida: Dunedin, Crescent City, and Biscayne Bay, the beetle is evidently native to Florida. But in this case it may well have been introduced from Mexico in the sewing basket. The outbreak occured in May, 1948.

The writer is indebted to Dr. Litterer for the data accompanying the specimens.

Pseudolampsis (Coleoptera, Chrysomelidae, Alticinae):

DISTRIBUTION AND SYNONYMY[1]

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In their paper on distributional and ecological notes on *Distigmoptera* and *Pseudolampsis,* Balsbaugh and Kirk (1968) indicated a comparatively large range extension for *Pseudolampsis guttata* (LeConte), i.e. from Louisiana and Alabama to South Carolina. However, these observations subsequently appear less significant since it has been learned that this very rare species also occurs in South America.

Because the illustration of *Distigmoptera darwini* Scherer (1964) did not appear to represent a true *Distigmoptera,* the author indicated this opinion to Dr. Gerhard Scherer, Museum G. Frey, Tutzing, Germany, who then very graciously loaned him a paratype of *D. darwini.* The paratype is indeed a rare specimen, having been collected by Charles Darwin while on his "Voyage of the Beagle" at Maldonado, Uruguay. To the author's amazement, this specimen (fig. 1) appeared to be conspecific with none other than the rare species *Pseudolampsis guttata* of southeastern North America (fig. 2).

A specimen of *P. guttata,* from Florence, South Carolina, was sent to Scherer when the paratype of D. darwini was returned to him. When he saw the Florence specimen Scherer[2] agreed that *Distigmoptera darwini* was conspecific with *Pseudolampsis guttata.* After making this comparison Scherer sent to the author 14 undetermined flea beetle specimens from Mato Grosso, Rio Caraguanatá, Brazil, collected by Plaumann, March, 1953. These specimens (fig. 3), Scherer felt, now that he had seen the Florence example of this species, were also probably P. *guttata.* Earlier, Scherer (1962) had stated that these Mato Grosso specimens were probably undescribed. Mrs. Doris Blake, U. S. National Museum, had indicated this to Scherer as her opinion after she examined two examples of the Mato Grosso series sent to her in 1962.[3]

The author agrees with Scherer's recent conclusion that these Brazilian beetles are indeed *P. guttata.* A comparison of the male aedeagus (figs. 4 and 5) collaborates this conclusion. Therefore *P. guttata* is now known from two localities in South America (Maldonado, Uruguay, and Mato Grosso, Brazil), in addition to Louisiana, Alabama, and South Carolina, in North America. These recent findings bear out Blake's (1943) hypothesis that *P. guttata* " . . . is possibly a subtropical beetle belonging to a group found more commonly in the tropics."

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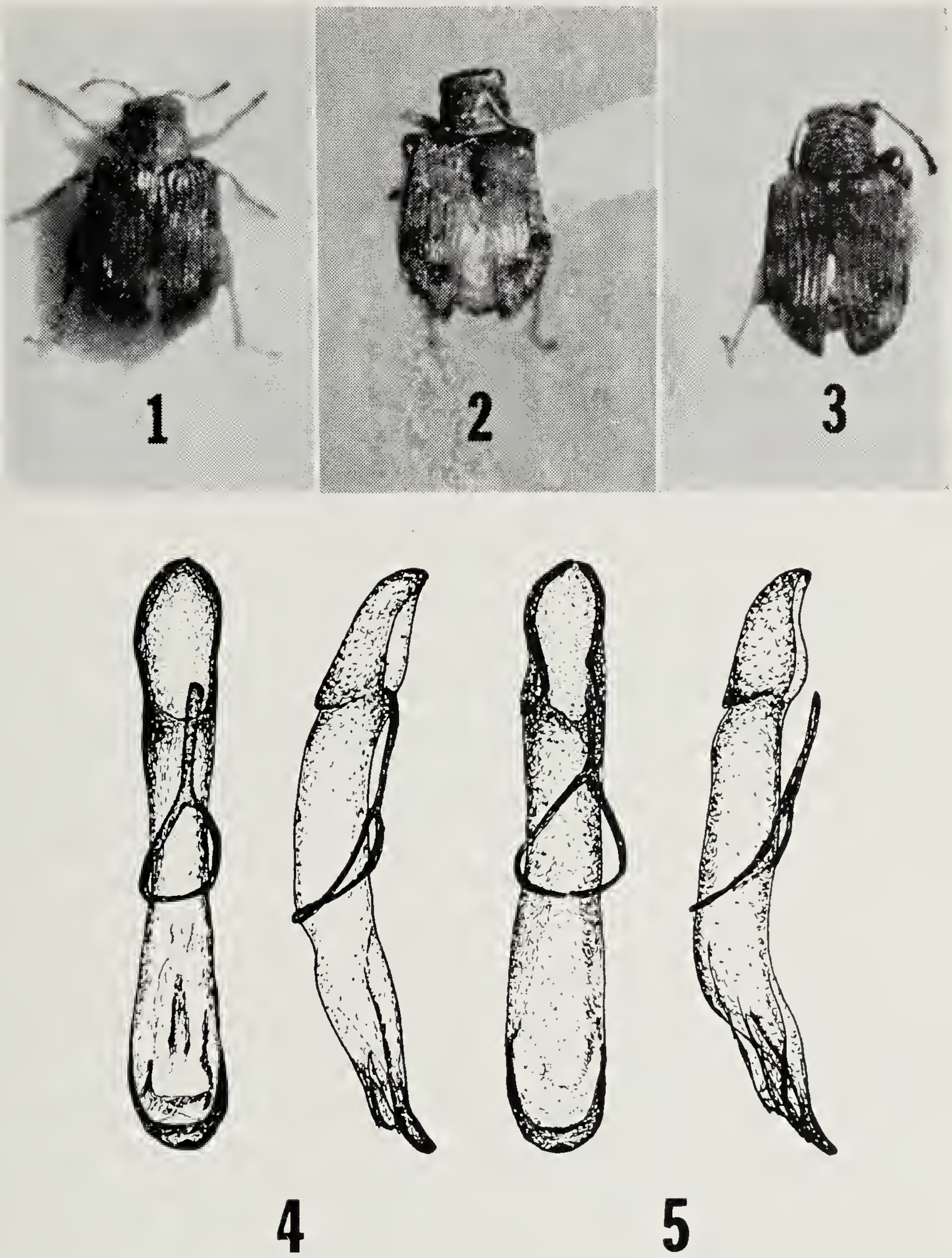
[1] Approved by the Director of the South Dakota Agricultural Experiment Station as Journal Series no. 856. Accepted for publication December 26, 1968.

[2] Personal communication. Letter from Dr. G. Scherer to the author. November 13, 1968.

[3] *Ibid.*



Figures 1-5. 1. Paratype of *Distigmoptera darwini* Scherer, Maldonado, Uruguay. 2. *Pseudolampsis guttata* (LeConte), Poinsett State Park, South Carolina. 3. *Pseudolampsis guttata* (LeConte), Mato Grosso, Rio Caraguanatà, Brazil. 4. Aedeagus of *Pseudolampsis guttata* (LeConte), Mato Grosso, Rio Caraguanatà, Brazil. 5. Aedeagus of *Pseudolampsis guttata* (LeConte), Poinsett State Park, South Carolina.

The synonymy of this species is as follows:

***Pseudolampsis guttata* (*LeConte,* 1884)**

Hypolampsis guttatus LeConte, 1884.

Pseudolampsis guttata (LeConte), Horn, 1889.

Distigmoptera darwini Scherer, 1964, NEW SYNONYMY.

Although LeConte's (1884) description of *P. guttata* is brief, it is nevertheless accurate enough to allow ready identification of the species. Horn (1889) gave quite a complete description, so that further elaboration is really unnecessary. However, comments on the specimens at hand are appropriate. Of the 14 specimens from Mato Grosso, Brazil, 13 are females. These range in total length from 2.3—2.6 mm, averaging 2.48 mm. They also tend to have the elytral disc deep reddish brown or piceous and clothed with fine fulvous pubescence. The single male (fig. 3) measures 2.2 mm in total length and has the elytral disc fulvous in color. The specimens from South Carolina are from the two localities previously cited by Balsbaugh and Kirk (1968), viz. Florence and Poinsett State Park. In these two series there are three males and six females. The males are smaller, measuring 2.2 or 2.3 mm in total length. They also are lighter in color than the females. The six females in total length range from 2.4—2.5 mm, averaging 2.46 mm. These have a darker elytral disc. As Horn (1889) indicated, the broadly emarginate last ventral abdominal segment serves to distinguish the male.

ACKNOWLEDGEMENTS

The author wishes to thank Dr. Gerhard Scherer, Museum G. Frey, Tutzing, West Germany, and Dr. Vernon M. Kirk, Northern Grains Insects Research Laboratory, U.S.D.A., A.R.S., Brookings, South Dakota, for the loan and gift of specimens. He also desires to recognize the assistance given by Drs. Kirk and Burrus McDaniel, the latter of the Entomology—Zoology Department, South Dakota State University, Brookings, South Dakota, for reviewing the manuscript.

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..................................1964. Eine neue *Distigmoptera,* die Charles Darwin während seiner Reise auf der "Beagle" fing. Einschliesslich neuen *Hypolampsis* und *Sparnus* Art (Coleoptera: Chrysomelidae: Alticinae: Monoplatini). Ent. Arb. Mus. Frey 15 (1): 296-301.

Book Review

SCHEDL, KARL E., 1966, Check List of the Scolytidae and Platypodidae from the Philippine Islands. Entomologische Abhandlungen, Staatlichen Museum für Tierkunde in Dresden. Bd. 35, No. 1, 122pp.

A list of 228 species of Scolytidae and 63 species of Platypodidae. For each species is given a reference to the original description, the location of the types, the type locality, synonymy, Philippine distribution and host data in detail, and generalized world distribution. The check list concludes with a taxonomic list of Philippine host trees with the Scolytidae and Platypodidae recorded from each. There is a systematic index of valid species by genera and an alphabetical list of generic and species names.—M. HATCH.

Note on the occurrence of *Trogoderma parabile* Beal in Massachusetts

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This paper reports research undertaken at the U. S. Army Natick (Mass.) laboratories and has been assigned No. TP-589 in the series of papers approved for publication. The findings in this report are not to be construed as an official Department of the Army position.

According to Beal (1959) there are 16 species of *Trogoderma* in the Nearctic Region. The six species frequently associated with stored foods include *T. glabrum* (Herbst), *T. inclusum* Le Conte, *T. ornatum* Say, *T. parabile* Beal, *T. simplex* Jayne, and *T. sternale* Jayne.

Beal (1959) stated that *T. parabile* occurred throughout the United States but was prevalent only in the drier areas. Loschiavo (1960) suggested that *T. parabile* could adapt to colder conditions and may become a pest of economic importance in Canada. Okumura (1967) found that *T. parabile* was frequently found in stored foods and had a wide host range.

Large infestations of *T. parabile* have not been reported from the northeastern U. S., and the following is an account of a sizeable infestation occurring in a store room and bakery in Natick, Massachusetts. On Oct. 11, 1968, several larval and adult specimens were submitted to the senior author for identification. The specimens were tentatively identified as *T. parabile*. Investigation of the collection sites revealed the presence of *T. parabile* in many subsistence items. The infested foods included Danish pastry mixes, cake mixes, flour, sugar, raisins, chocolate, chocolate cake bars wrapped in heavy aluminum foil, and apricot bars wrapped in foil. Practically all foods in the supply room were infested except those stored in metal canisters. Several adults were collected near the windows of the bakery.

This *T. parabile* infestation clearly shows that these insects and other stored food product pests still present a serious problem of food contamination in its various stages of preparation, distribution, and storage. Insect contamination of foods is compounded by a definite marketing trend that creates a great variety of precooked, convenience foods. The importance to human consumption of these foods is considerable when one learns that little or no cooking is required, thus making the ingestion of harmful contaminants more than a remote possibility.

The authors extend their thanks to Dr. George T. Okumura, California Bureau of Entomology, for confirming the identification of *T. parabile*.

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Longevity and Color Change in the Rhinoceros Beetle, *Dynastes tityus* L. (Coleoptera: Scarabaeidae)

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The rhinoceros beetle, *Dynastes tityus* L., has been collected in both pear-green and mahogany-brown color phases. Reports of color change and variation have been made by Fattig, Hamilton, Manee, and Ritcher. Hamilton (1886) reported that he received brown male and female specimens which, after about eight weeks, changed to the usual color, i.e., green with brown spots. There have been two separate reports of color difference in individuals but without observed color change. Ritcher (1944) gave an example of 15 pupal cases containing adults which were dug from an old wild-cherry stump. "Of these, 8 individuals were spotted, 5 had one elytron spotted and the other of a solid mahogany color, and 1 beetle was of a uniform mahogany color." Manee (1915) reported having found the same type of color variation. He believed this to be an example of mimetic coloring, with the beetle taking on the color of the rotten fruit on which it fed. Color change in preserved specimens was observed by Fattig (1933). He reported that 11 of 16 specimens which had been kept under identical conditions in his collection, had changed from green with brown spots to entirely brown. The change varied between specimens, taking place either on one or both elytra or the thorax.

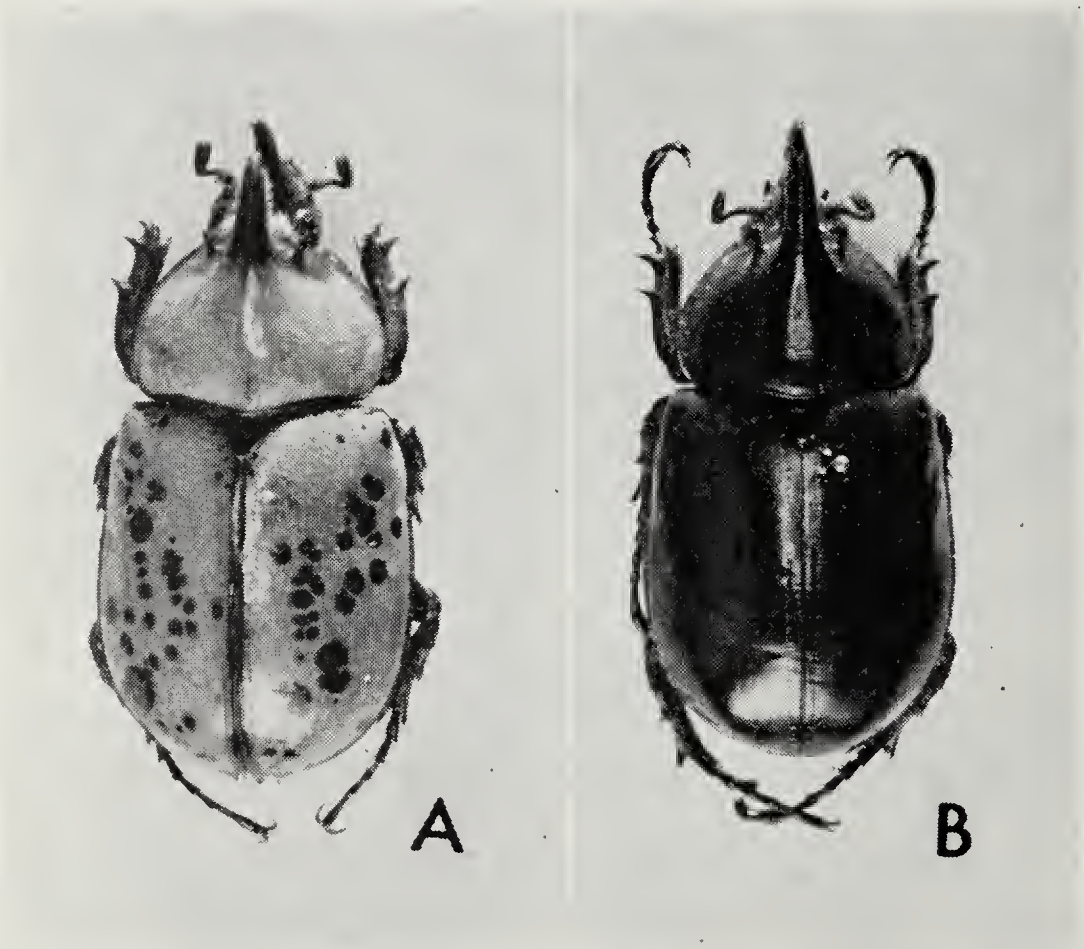

FIG. 1. Male rhinoceros beetles, *Dynastes tityus* L., showing variation in color. A. Green Phase. B. Brown phase. (Pinned specimens from the collection of Field Museum of Natural History.)

A living male, collected in Blythesville, Arkansas, by Mr. J. Branum, was given to Field Museum of Natural History on July 10, 1967. The specimen survived in our laboratory until April 2, 1968, on a diet of peaches, pears, grapes, and apples. When food was present, the beetle spent most of the time sitting on the fruit and feeding. During this period of nearly nine months, the beetle underwent several color changes. When first received, it was green with brown spots. During the first 10 days in the laboratory, while feeding continually, it slowly turned to a deep mahogany color. It was then left without food, and within three days returned to its former green color. The color extremes are shown in figure 1. During this period without food, the beetle was very active. It returned to the brown phase on two subsequent occasions, July 23 to September 20, 1967, and September 23 to 30, 1967, after a period of feeding. Each time the beetle was subsequently deprived of food, it returned to the green color in two or three days. From October 4, 1967, to April 2, 1968, the beetle was continually provided with food, and remained brown in color except for small areas of the elytra and pronotum which turned greenish. The time intervals for color phases and feeding is shown in figure 2.

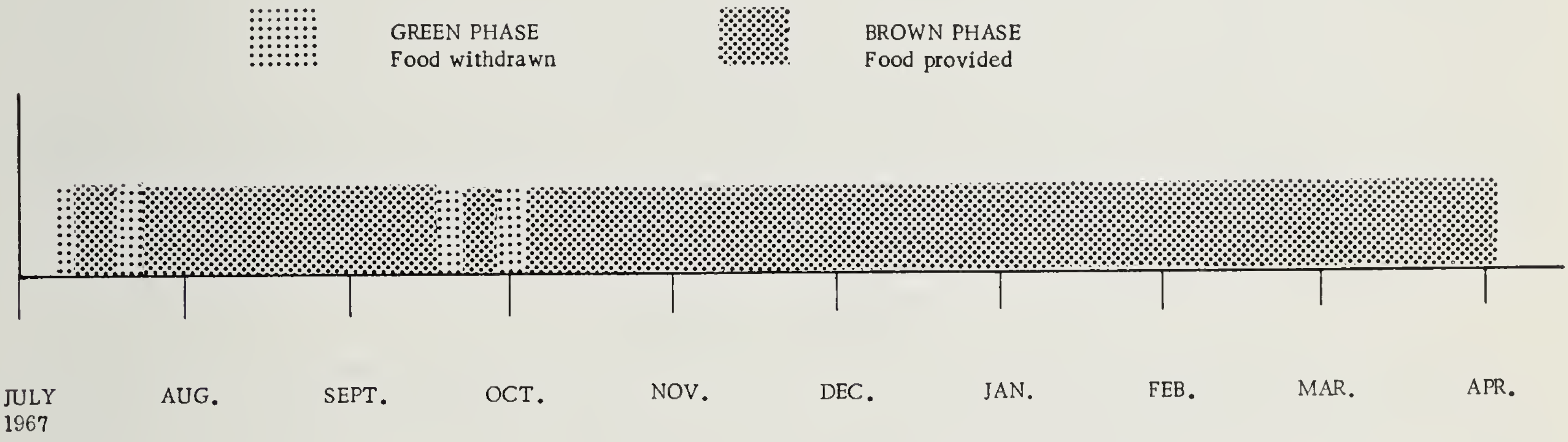

FIG. 2. Time of occurrence and duration of color change in a live specimen of *Dynastes tityus* L.; in relation to periods of feeding and food withdrawal.

Examination of the elytra of green specimens revealed that the green color is in a thin layer on the surface of the integument. This layer may be scraped off leaving a dark amber colored layer below. Without this outer layer the color will not return to green. The normally brown spots are areas that lack this green layer. Dark specimens have a characteristic wax or grease coating which seems to interfere with the green color. Degreasing with acetone or other fat solvents will restore the green color of preserved specimens. While examining preserved specimens, under 48x magnification, it was noted that the heat of a high intensity lamp promoted the movement of a fluid substance within the elytra and small area of the elytra changed to green as if drying out.

Because the living beetle's change to brown was observed during periods when it was continually provided with food, it is suggested that an increase in the fluid level during feeding, combined with the presence of fatty substances in the haemolymph may account for the change in color of the integument. If these fats remain within the elytra after the specimens have been preserved, rises in temperature may account for color changes after death. It is hoped that this note will stimulate interest in the physiological mechanism responsible for color change. The longevity of the beetle and the ease with which it is kept alive make it a very suitable insect for laboratory studies.

Dr. Ulrich F. Danckers of River Forest, Illinois, has a small live male of *Dynastes hercules* L., obtained from a dealer, which he has kept for nearly two months on a diet of raw apples. He has noted the same kind of color changes associated with feeding and withdrawal of food.

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ACKNOWLEDGMENTS

I wish to thank Dr. Rupert L. Wenzel and Mr. Henry S. Dybas, Field Museum of Natural History, for their helpful comments and criticisms of the manuscript. I also thank Dr. Ulrich F. Danckers for notes on color change in *Dynastes hercules* L.

FIELD NOTE

Notes on Additional Distribution and Ecology of Eubrychiopsis lecontei Dietz (Coleoptera: Curculionidae.—While studying the macroinvertebrates associated with the submerged aquatic plant species *Myriophyllum spicatum* L. in Labrador Pond, Onondago County, New York, several specimens of *Eubrychiopsis lecontei* Dietz were collected. In total, 23 individuals weighing 29 mg. were taken on seven different occasions during June, July, and August of 1966. Rose Ella Warner of the Systematic Entomology Laboratory, U. S. Department of Agriculture, Washington, D. C. kindly confirmed the identification. She also stated that the species was previously unrecorded from New York, with the nearest U. S. National Museum specimens being from Detroit, Michigan (personal communication).

These organisms were identified as *Phytobius velatus* Beck. This identification is correct according to Blatchley and Leng (1916, *Rhynchophora or weevils of North Eastern America,* 682 pp.) and Leng (1920, *Catalogue of the Coleoptera of America north of Mexico.),* but this species does not occur in North America (same personal communication as above).

Labrador Pond is 150 acres in size and its deepest point is not over eight feet. The bottom consists of a soft muck, with both submerged and floating aquatics being common. *M. spicatum* probably predominates. Labrador Pond lies at the headwaters of the Chesapeake Bay drainage area, with the St. Lawrence drainage area beginning less than a mile north of the pond. This geographic distinction, alone, should encourage extensive sampling both north and south of the height-of-land that separates these two major drainage systems.

Although emphasis was placed on sampling *M. spicatum,* several other plant species were collected and none of them harbored *E. lecontei. Elodea canadensis* Michx. and *Potamogeton americanus* C. & S. are notable for their lack of *E. lecontei.* Whenever *E. lecontei* was taken they were always associated with fairly dense growths of *M. spicatum.*—JOHN N. KRULL, *Southern Illinois University, Carbondale, Illinois.*

An Aberrant Trifurcate Tarsus in *Elaphidion mucronatum* (Say) (Coleoptera: Cerambycidae)

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BOWLING GREEN STATE UNIVERSITY

BOWLING GREEN, OHIO

Several specimens of *Elaphidion mucronatum* (Say) were collected by Mr. Dennis Robarge in Bowling Green, Ohio, on April 28, 1968. One of these, a male, possessed an abnormal, trifurcate, right protarsus. All other tarsi and other external features are perfectly normal.

The aberrant protarsus is illustrated (Fig. 1). The morphology of this tarsus is either tripled or otherwise highly modified.

The 1st and 2nd tarsomeres are abnormally wide—the 1st being approximately double the normal width, and the 2nd nearly three times the width of a normal segment. The enlarged 1st tarsomere provides a base for the enormous 2nd segment, to which three 3rd tarsal elements attach. Both normal and abnormal protarsi are the same length (ca. 2.9 mm.).

The 1st and 2nd tarsomeres are not actually divided but show related modifications. The setose ventral pad (or "brush") of the 1st segment is divided into two unequal parts by a narrow glaborous strip. The 2nd tarsomere is also unequally divided: the anterior portion being connected to two of the 3rd tarsal segments and having an abnormally large "brush," while the posterior portion (with a more normal ventral "brush") connects with only one of the 3rd tarsomeres.

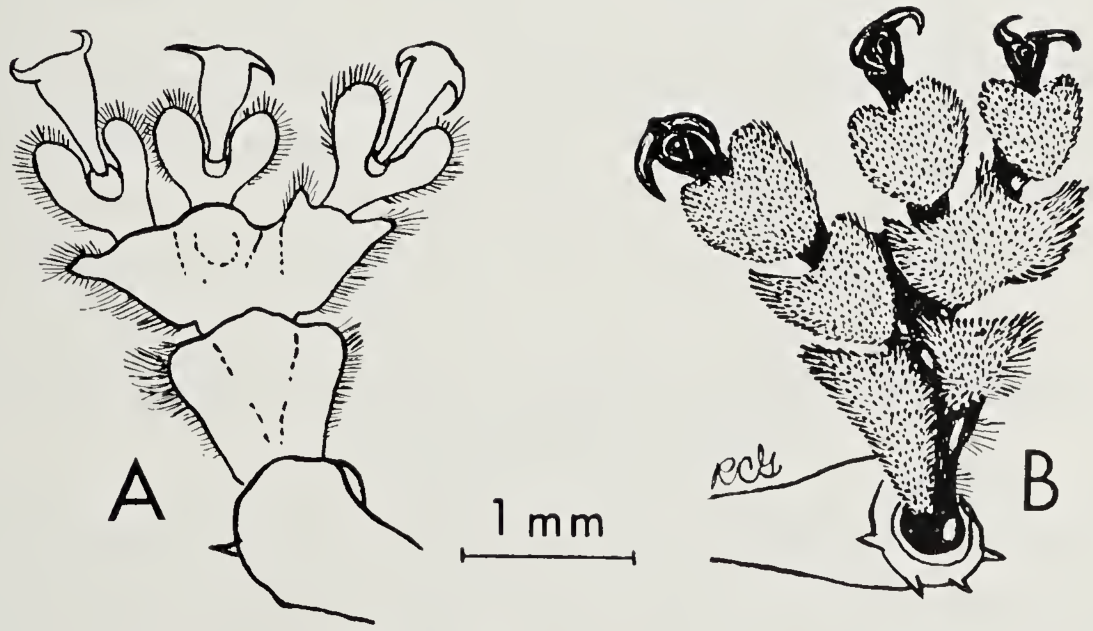

FIGURE 1. Trifurcate right protarsus of *Elaphidion mucronatum* (Say), male: (A) dorsal view; (B) ventral view (tarsal pads stippled). Other setae are not shown.

The tripled distal tarsomeres (3, 4, and 5) appear essentially normal except that the posterior set is the larger of the three. The lobed 3rd tarsomeres with their ventral "brushes," the minute 4th segments, and the claw-bearing 5th tarsomeres are otherwise normal in appearance.

No difference in length exists between aberrant and normal tibiae and femora, but the right tibia is enlarged at the apex and bears 4 apical spines instead of the normal two. Like the 1st and 2nd tarsomeres, the tibia is not actually divided but shows duplicated structures.

The specimen appeared to walk "with a baseball catcher's mitt" on one leg, but this did not seem to interfere with its locomotory ability. However, most of the setae are worn from the anterior basal portion of the abnormal 1st protarsomere (see fig. 1-B). This may be due to some difficulty in moving this tarsus while walking.

Trifurcate and bifurcate antennae have been reported in several species of Coleoptera but I could find no reference to such aberrations in the tarsus, perhaps indicating that tarsal abnormalities are extremely rare. Wood (1965) describes a trifurcate antenna in *Cicindela scutellaris lecontei* (Hald.) and Gerhardt and Turley (1963) report another in *Megacyllene antennatus* (White). Photographs of both of these trifurcate antennae show a curious asymmetry, in that one of the forks is larger than the other two; the same asymmetry that exists in the tarsus described here. The bifurcate antenna in *Cicindela nevadica knausi* Leng does not appear to show such an asymmetry, both branches appearing approximately equal (Willis, 1967; figs. 85, 86). There must be a basic reason for this but I have no explanation to offer at present, nor do I know what may have caused these deformities.

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Ecosystem economy: *Onthophagus* using a *Canthon* brood ball.

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On August 1, 1967, on the gravel road just outside of Guadalupe Canyon (Arizona, Cochise County, Peloncillo Mts.) my wife and I noticed great numbers of dung beetles swarming around some fresh cow dung. Stopping for a closer look we watched for some time as sexual pairs of the large black *Canthon imitator* Brown and the smaller metallic green or blue *Canthon indigaceus* *chevrolati* Harold (Scarabaeidae: Scarabaeinae) worked side by side on the fresh dung, cutting away material and forming their rough brood balls. Across the surface of the gravel road and in the adjacent ditch numerous pairs of both these species laboured over their brood balls, pushing and pulling them along the ground, gradually forming a firmer more evenly shaped ball.

In what appeared to be more random happenstance than plan, brood balls were often deserted by a lone male or sexual pair or an incoming male would replace the original one. Many half-formed deserted balls were scattered about next to the dung source. While examining some of these deserted brood balls, both partially and wholly formed, I noticed one with a small hole in one side, apparently the entrance to a burrow of some kind. Breaking open this very firm wholly formed abandoned brood ball of *C. imitator* I found deep inside a single specimen of the small (length 5 mm., width 3 mm.) metallic green and yellowish *Onthophagus hopfneri* Harold. The *Canthon* sp. brood ball containing this specimen was some 18 mm. in diameter ($\bar{x} = 19.40$ mm. when $n = 5$ fully formed balls). Examination of not only other abandoned *Canthon* balls but of the dung source itself failed to turn up any other specimens of this interesting *Onthophagus* species. Howden and Cartwright (1963) recorded that this species is apparently a general dung feeder and that its life history is entirely unknown. *Onthophagus* species normally construct their brood cells 1 to 9 inches deep, at the edge of or beneath the dung source. The brood cell is packed full of dung and the egg laid within a cavity scooped out of the same. This adult of *O. hopfneri* seemed to be exploiting the abandoned *Canthon* brood ball for a food source rather than using it for brood cell supply, however.

Concerning *how* the *Onthophagus* came to be inside the *Canthon* ball rather than feeding on the readily available dung source, the thought occurs that perhaps he was "rolled up" so to speak by the working *Canthon*. Presence of the entrance burrow into the *Canthon* ball effectively disproves this idea. *Why* the *Onthophagus* would feed in this ball rather than on the source is an interesting though unanswered question. Nonetheless, this observation is offered as another example of what might be termed the economy of the ecosystem, reminding us that the ecosystem is that dynamic natural unit within which species interact not only with one another but with all of the requisites of life. Even though potential energy was abandoned by one species it was, in this case, exploited by another, resulting in a more perfect economy.

ACKNOWLEDGMENTS

The field studies during which these observations were recorded were partially supported by a David Ross Fellowship awarded by the Purdue University Research Foundation and a Grant-in-Aid of Research awarded by the Society of Sigma Xi. To both of these sources I owe my sincere thanks.

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Two Flights of *Scaptolenus* (Coleoptera: Cebrionidae)[1]

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My first experience with a flight of *Scaptolenus* was at Puerto de la Angostura, 47 km. S. of Ciudad Victoria, Tamaulipas, Mexico, a locality at the edge of a small plateau covered by an old lava flow and shown on the map as at ca. 500 m elevation. W. L. Nutting and I had selected a camp site next to the highway, near a small valley with fairly lush scrub vegetation, on May 25, 1948. We set up a funnel light trap in the valley, using a Coleman gasoline pressure lantern as the light source. A heavy rain started soon after we had set up our tent, and kept up well into the evening. It rained so hard that we didn't check the light trap before retiring. Several *Scaptolenus* males found their way into our tent in the evening, apparently attracted to our lantern. The trap lantern was still burning at dawn, and the killing jar and bottom of the funnel were packed with *Scaptolenus* males. Specimens of the two species in the trap have been identified by E. C. Becker as *S. mouffleti* Chevrolat and S. sp., the latter smaller and more rufous, and by far the more abundant. We could not find any females in the area. A local resident informed us that it had not rained for seven months previous to our visit.

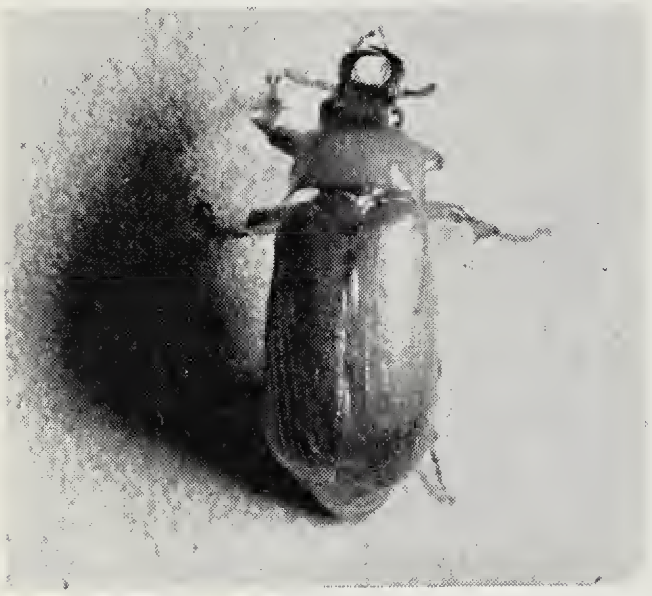
Figure 1. *Scaptolenus fuscipennis* Fall, female.

I have had one other experience since, with *S. fuscipennis* Fall. This flight was also associated with heavy rain. I had taken my family to Parker Canyon Lake, on the west side of the Huachuca Mts., Cochise Co., Arizona, at ca. 5500' elevation, on July 17, 1966. The lake is man-made and a favorite fishing location. We arrived at about 12:30 P.M., just in time for a rainstorm, which soon became torrential. When the storm had passed, we found several *Scaptolenus* males floating on puddles in the picnic area.

The sky remained overcast all afternoon. About twenty more males were taken or seen in flight on the slope on which the picnic area has been constructed, in an area of scattered oak trees, a few shrubs, and a moderately sparse cover of grass and herbaceous vegetation. Many more males were found in the water at the edge of the lake. Most of these were still alive, and many had crawled out onto plant stems. At about 3:00 P.M. a cluster of males was found on the ground and a female in the center of the cluster. A search of at least an hour by five people turned up one more cluster and female. This female was in a clump of grass, and seemed to be at the entrance to a short hole. By 4:30 P.M. there were no more males flying. In all, 121 males and two females were taken.

There had apparently been one or two previous rains at this locality during the start of the monsoon season, but I have been unable to obtain exact records.

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[1] University of Arizona, Agricultural Experiment Station Journal Article no. 1376.

Several dead males found in the lake may have been left over from previous rains and flights.

The female figured was photographed alive in the laboratory. The two females are very similar to each other, ca. 13.5 mm long from the front of the head, behind the mandibles, to the tips of the elytra. The wings of these females are approximately 8.0 mm long and the elytra 9.5. The wings are obviously smaller than those of the male, because the hind margins don't quite reach the midline in repose. The wings of the males are slightly longer than the elytra, and overlap almost to the anterior edge of the opposite wing in repose. The males are quite uniform, varying from ca. 14.0 to 16.5 mm from front of head minus mandibles to tips of elytra.

A New Synonym of *Metamasius anceps* Gyllenhal (Curculionidae, Rhynchophorinae)

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AMERICAN MUSEUM OF NATURAL HISTORY

While looking for other material in the Muséum National d'Histoire Naturelle, Paris, I came across the type of one of Blanchard's species, *Sphenophorus rubro-tesselatus,* described in 1846 from D'Orbigny's voyage (1846, p. 204). The locality given is the province of Chiquitos, in the state of Santa Cruz, Bolivia, and the type is labeled "Museum Paris Guarayos D'Orbigny, 1834," Guarayos being in Chiquitos, east of the city of Santa Cruz. This specimen is at once recognizable as conspecific with *Metamasius anceps* (Gyllenhal), 1838, new synonymy. There is no mistaking *anceps* as it is the only member of the genus that has the scutellum strongly emarginate (bilobed) in front. *M. bilobus* Hustache is also a synonym (Vaurie, 1966). Gyllenhal, unfortunately, did not stress the scutellum, saying merely that it was "oblongo-triangulare," but I have seen his type and the scutellum is distinctly emarginate.

Sphenophorus rubro-tesselatus appears in the Junk catalogue (Csiki, 1936) as a variety of *Calendra* [now *Sphenophorus*] *cincticollis* Gyllenhal, and *anceps* as a synonym, with a question mark, of *Rhodobaenus tredecim-punctatus* Illiger, an entirely different species. The name *anceps* does not appear at all in Blackwelder (1947), probably because the type locality is "America septentrionalis," instead of "australis" or "meridionalis." The species occurs in South America from Colombia south to Bolivia.

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BEETLE TALK

With reference to the paper by Garland T. Riegel entitled *Confused water beetles* (Coleopt. Bull. 17: 64), the following is of some interest.

In this note, Dr. Riegel states that the dytiscids were attracted to storm windows which were placed on sawhorses to be painted. I recently read the following statement regarding dytiscids in a book entitled *"World's Natural History or Living Creatures of Land and Sea,* etc.," a very interesting book published in 1904 (author and publisher are not listed):

> "Towards evening this, in common with many other Water Beetles, is accustomed to leave the streams, to spread its wide wings and to soar into the air. In the early morning it again seeks its watery home, and is accustomed to save time and exertion by closing its wings and dropping like a stone as soon as it perceives the water below. Sometimes, however, it is direfully disappointed, mistaking the glitter of glass, such as the sashes of cucumber frames, the tops of green-houses, and similar objects, for the water in which it is accustomed to plunge, and in consequence receives no small shock when it comes in contact with the hard glass."

So this interesting behavior apparently has been noticed before.—ROBERT C. GRAVES, Bowling Green University, Bowling Green, Ohio.

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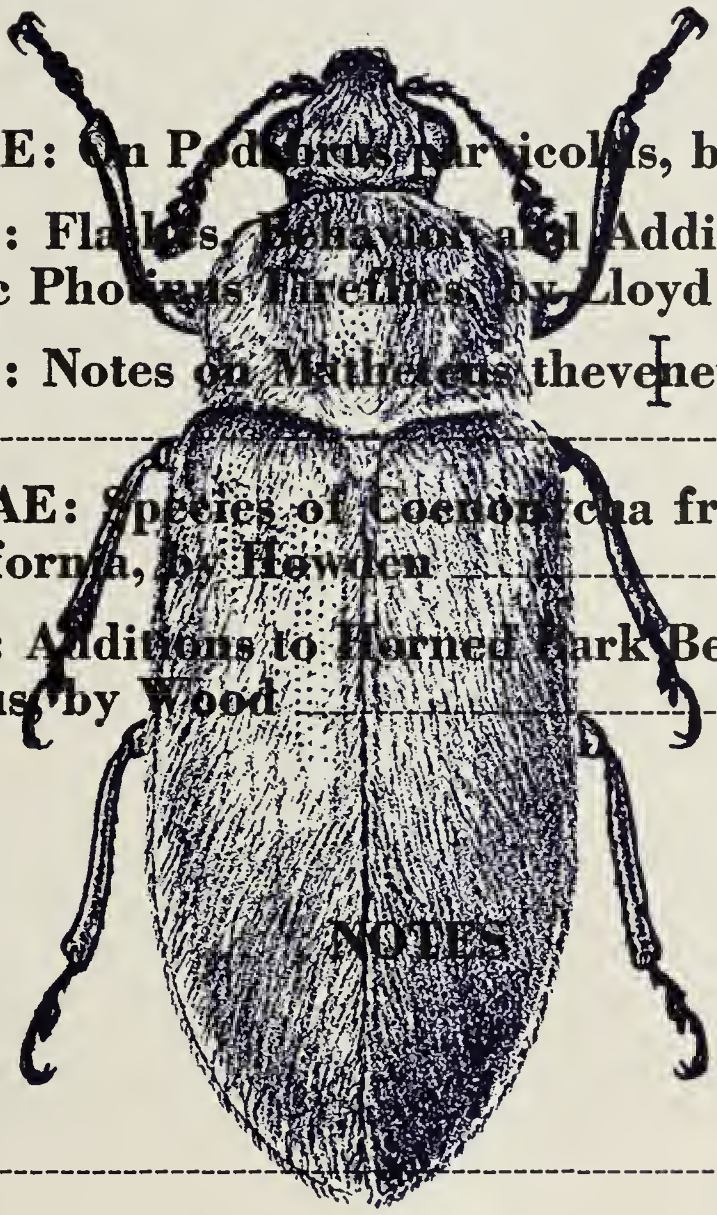

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THE COLEOPTERISTS' BULLETIN

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THE COLEOPTERISTS' BULLETIN

VOLUME 23 JUNE 1969 NUMBER 2

Flashes, Behavior And Additional Species Of Nearctic *Photinus* Fireflies (*Coleoptera: Lampyridae*)

JAMES E. LLOYD

UNIVERSITY OF FLORIDA

This paper reports some recent behavior observations, resurrects a LeConte species and describes two new species. Methods of study were similar to those used previously (Lloyd, 1966a, 1968); however, a different system was used to record firefly flashes. Flashes were detected by a photo-multiplier tube, transduced to a frequency-modulated audio signal that varied proportionally (9-12 kc) with light intensity, and recorded on magnetic tape (7.5 ips). For analysis, recorded tones were transduced to a variable dc voltage that was then fed into a storage oscilliscope with a calibrated time-base. The recording system was designed and built by Alton Electronics, Gainesville, Florida.

Photinus acuminatus Green

This species was previously known from two specimens: male holotype, Pisgah Mt., North Carolina, and a female, Newberry, Florida. In June, 1968, I found a large population at the edge of a cypress-head in Dixie Co., Florida, near the Suwannee River, 15.3 miles S.W. of Old Town on Route 349. Flashing occurred in shrubs and small trees (willow, waxmyrtle, buttonbush).

BEHAVIOR—The behavior of this species is similar to that of other species in Division 1 (Lloyd, 1966a). Flashing activity occurs at twilight and is of short duration; the mating code is a simple flash-answer; and it seems to be a border or ecotone inhabitant. It differs from other *Photinus* in that flashing activity *begins* 2-7 meters above the ground in the foliage of trees and shrubs. Other nearctic *Photinus,* with the possible exception of *P. sabulosus* Green, begin activity at ground level and later in the evening (at low light intensities) a few stragglers fly at higher altitudes.

Male flashing activity began 12-16 minutes after sunset at high ambient light levels (west exposure) and terminated about 30 minutes later. The flash pattern is a single, very bright flash, estimated to be less than 0.1 sec in duration; apparently shorter than that of other nearctic *Photinus.* Flash pattern intervals were about 2 sec in duration at 74°F, although longer intervals occurred when males flew from one branch or shrub to another.

Four females were found. They were perched 1-2 meters above the ground and responded to flashes of males and a flashlight with extremely bright flashes at short time delays. The response flashes of one female were recorded: her average delay time (from the beginning of the stimulus flash) was 0.29 sec (range = 0.26-0.31, n = 20, 74°). This female emitted a double flash (Fig. 1) as occasionally observed in both males and females of other *Photinus* that characteristically have single flash signals. The first flash averaged 0.08 sec in duration (range = 0.07-0.10) and the second 0.07 (range = 0.04-0.10).

The apparent ecology and distribution of this species is puzzling, for *acuminatus* is known from a cypress swamp in Florida and a boreal mountainside in western North Carolina.

Photinus ardens **LeConte,** ***Photinus obscurellus*** **LeConte**

Observations on mating behavior have revealed that *ardens* and *obscurellus* are distinct species, although subsequent to naming them (1852) LeConte considered *obscurellus* a variety (1865) and then a synonym (1881) of *ardens*. *P. frigidus* E. Olivier is a synonym of *obscurellus*, and *taedifer* LeConte presumably that of *ardens* and a nomen nudum.

BEHAVIOR OF OBSCURELLUS—I have previously described the behavior of *obscurellus* under the name *ardens* (Lloyd, 1966a).

BEHAVIOR OF ARDENS—*P. ardens* was observed in marshes near Verona, Oneida Co., and Peterboro, Madison Co., and a pasture-marsh near Antwerp, Jefferson Co., New York. Its habitat is similar to that of *obscurellus*, and the latter was also seen at each of these three sites. During previous observations of *obscurellus* at several sites, *ardens* had not been seen.

Males begin flying and flashing one hour after sunset and continue for about an hour. They emit a flash pattern of two, three and rarely four pulses (Fig. 2), while flying slowly at altitudes up to three meters. Flash pattern intervals (from beginning of one pattern to beginning of next) are 10-20 sec in duration. Pulse intervals (from beginning of one pulse to beginning of next consecutive pulse) within flash patterns are from 0.66-1.0 sec at 61-66° (versus 0.43-0.6 in *obscurellus*)[1]. Each pulse is 0.30-0.41 sec in duration (versus 0.18-0.22 in *obscurellus*, Figs. 3, 4) at 66°.

Females were found perched on marsh grass and shrubs. They responded to male and artificial flash patterns with a single flash (Fig. 5) at delays from 5.8-8.5 sec in duration (from the beginning of the last stimulus pulse) at temperatures from 58-65° (versus from 1-3 sec in *obscurellus*). One female occasionally emitted a two pulse response as noted in females of other *ardens*-group species (Lloyd, 1966a) but none emitted bimodel pulses as found in *obscurellus* (Fig. 6). Males of both *ardens* and *obscurellus* commonly emit phrases of four or more pulses after they have landed near answering females. Then females of *obscurellus*, but not those of *ardens*, frequently interrupt male phrases and flash a response during the males' lengthened phrase.

NOTES—The type locality of *ardens* is Lake Superior and of *obscurellus*, Missouri Territory, which existed officially from 1812-1821 (Paullin, 1932). At the time LeConte named *obscurellus* there was no official Missouri Territory. The presently known range of *obscurellus* extends into what had previously been Missouri Territory and what was in 1852, Minnesota Territory (Fig. 12).

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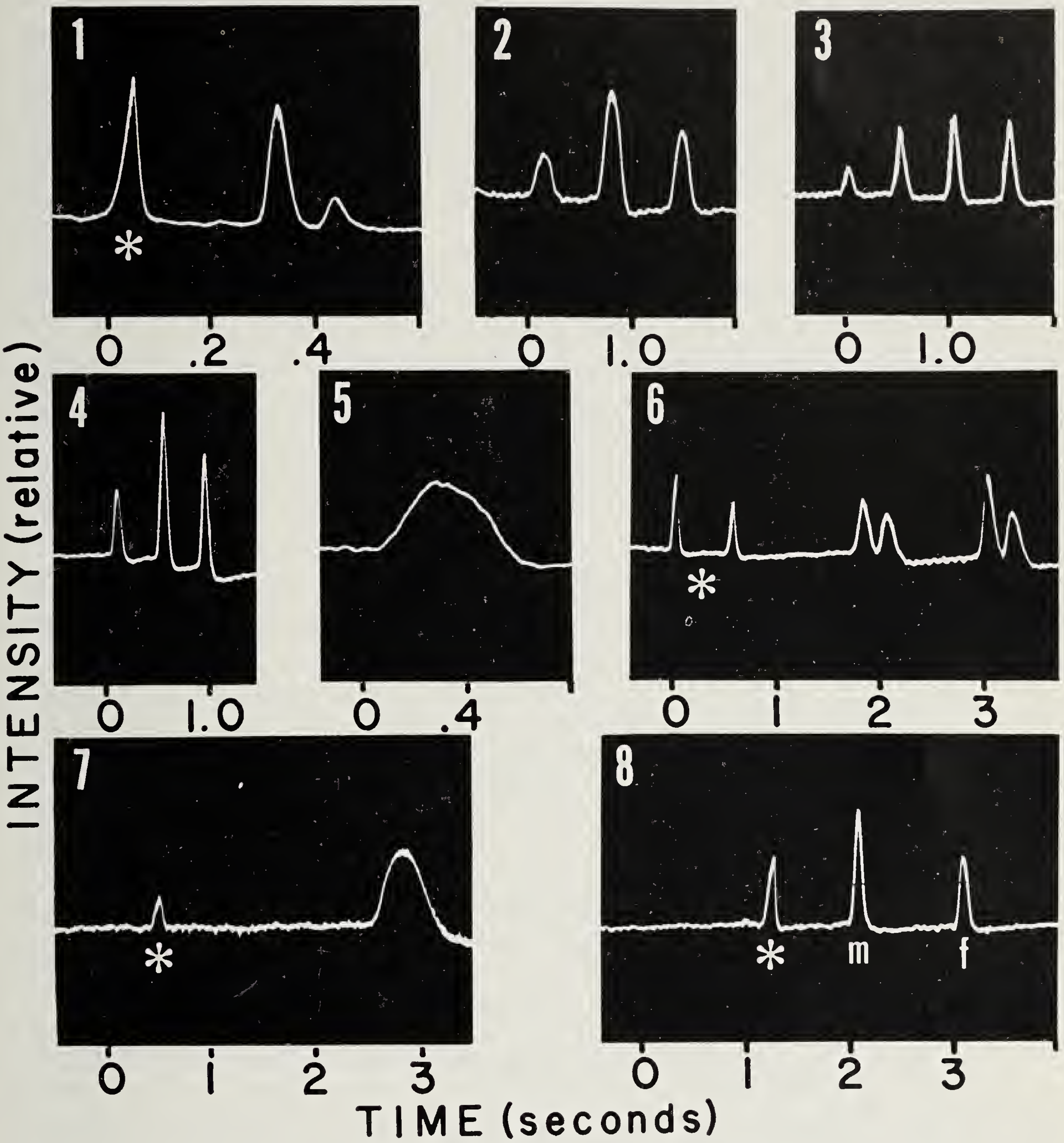
[1] The number of significant figures in pulse interval measurements varies since stopwatch and electronic readings are given together.



FIGURES 1-8.—Fig. 1. Flash response of *acuminatus* female to artificial flash (*) stimulation (74°); Fig. 2. Last three pulses of a four-pulse flash pattern emitted by perched *ardens* male (66°); Fig. 3. Four-pulse flash pattern emitted by a perched *obscurellus* male (66°). Flying males emit two and three pulse phrases; Fig. 4. Three-pulse flash pattern of perched *obscurellus* male (66°); Fig. 5. Flash response of *ardens* female (66°). This flash was emitted 6 sec after last pulse of artificial stimulus flash; Fig. 6. Flash response of *obscurellus* female (66°). This response, composed of two doubled flashes, was stimulated by artificial flash pattern (*); Fig. 7. Flash response of *aquilonius* female to artifical flash (*) stimulation (68°); Fig. 8. Flashes of male (m) and female (f) *greeni* (75°). Flash pattern of this species is composed of two pulses. In this sequence the first pulse of the flash pattern was emitted by an artificial flasher (*).

I have examined LeConte's specimens and compared my behavior voucher specimens with them; I encountered no difficulty in associating my series with LeConte's specmens, *P. ardens* is longer (behavior voucher, $\bar{x}$ = 11.0 mm, range = 9.7-12.0, n = 29; versus $\bar{x}$ = 9.3 mm, range = 7.0-10.9, n = 35, in *obscurellus*). Both have brown pronotal maculae, a character known elsewhere in nearctic *Photinus* only in *P. aquilonius* n. sp. (below). In general appearance, *obscurellus* is black and *ardens* tan or dusky. Age seems not to have affected the color of the *obscuerllus* type and it remains black after more than 100 years.

In museum material identified as *ardens* by Green and others there are some specimens that lack the brown pronotal maculae. Since only one of the behavior vouchers lacks this character, I believe that most of these specimens are *Photinus consimilis* Green. Nine specimens in the LeConte collection were labelled *ardens* by N. Banks (Darlington pers. comm.) and numbered 1-9. No. 1 is the *ardens* holotype (male), and No. 7 is the holotype of *obscurellus* (male). No. 2 and 5 are *ardens* females, No. 3 an *obscurellus* female, Nos. 4 and 8 males of the *consanguineus* group, No. 6 an *aquilonius* n. sp. male (below), and No. 9 a female from La. (Louisiana?), possibly a *consimilis*.

The two species may be separated with the following extension of Green's (1956) key:

28. Male flash pattern as in Fig. 4 (snappy pulses delivered briskly); interval from the first pulse of one pattern to first pulse of next pattern less than 8 seconds in duration; female delay less than 3 seconds in duration; female response-flashes bimodal (Fig. 6); elytra black with well defined yellow margins; epipleura black; each elytron without thread-like, pale, medial line .... **obscurellus**

Male flash pattern as in Fig. 2 (sluggish pulses delivered leisurely); interval from first pulse of one pattern to first pulse of next pattern more than 10 seconds in duration; female delay more than 4 seconds in duration; female response-flashes unimodal (Fig. 5); elytra pale or dusky with margins poorly defined; epipleura pale or dusky with pale areas; each elytron with thread-like, pale, medial line .... **ardens**

Photinus consimilis Green

P. consimilis includes two morphologically cryptic species presently known as Fast-Pulse and Slow-Pulse (Lloyd, 1966a). I have observed the Fast-Pulse flash pattern in Jefferson and Oneida Cos., New York, in Alachua Co., Florida, and at the *consimilis* type locality, Roaring River State Park, Barry Co., Missouri; the Slow-Pulse species has been seen in Dade and Alachua Cos., Florida. At two sites in Alachua Co., both species have been found, and at one of these sites in the spring of 1967 a few individuals were observed emitting a flash pattern that appeared to be intermediate in pulse rate and length, and was intermediate in pulse number (4-5 versus 4-9 and 2-3). No intermediate flashers were seen in the spring of 1968 at this site. However, a large population of intermediate-flashers were seen in Leon Co., Florida, and neither the Fast nor Slow-Pulse flash-pattern was seen. Pulse number in this population was 3-4 and not 4-5 as observed in Gainesville. These intermediate *consimilis* are of considerable interest zoogeographically since they occur in a well-known area of secondary intergradation (Remington, 1968).

Photinus aquilonius Lloyd, NEW SPECIES

Behavior—A deme of this species was found in a marsh in Washtenaw Co., Michigan, and observed June 25-30, 1966. The male flash pattern is a single flash estimated to be about 0.25 sec in duration at 65°. Flash pattern intervals were variable (perhaps flashes were omitted) and ranged between 3.7 and 12.0 sec with modes at 4 sec and 6.5 sec (65-68°). Only one or two individuals could be seen at one time, and they were flying with members of at least 10 other flashing species.

Females were found perched on marsh grass and shrubs. They answered male and artificial flashes with single flashes at moderate time delays (Fig. 7).

The behavior of this species is similar to that of *ignitus* but the female delay is shorter (Fig. 10). The habitat of *P. ignitus* is pastures, hayfields, meadows and old fields although occasionally I have found individuals at marsh edges. *P. aquilonius* appears to be a marsh species since females, which presumably don't fly before mating, were commonly found on marsh plants surrounded by standing water.

Once I saw an *aquilonius* female answer the 3-pulse flash of an *obscurellus* male. He turned and flashed again; she again answered and he flew off.

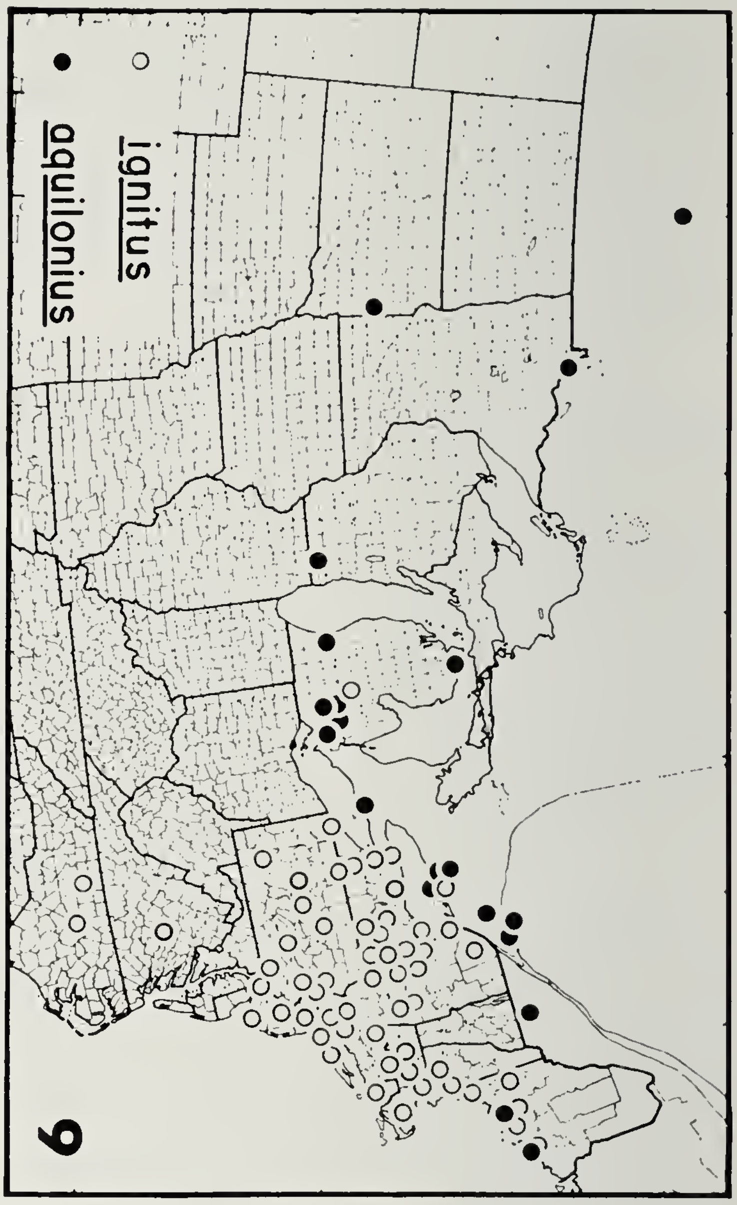
Holotype—Male. Form narrowly elongate. Length 7.4 mm. Eyes large, separated medially above by less than diameter of eye. Pronotum with disk brown, pink pigment not visible dorsally. Scutellum brown, paler at tip; mesonotal sclerites brown. Elytra brown; sutural bead pale, continuously around apex. Lateral pale elytral margin of same width as flange. Hypomera, legs and coxae brown. Thorax dark brown ventrally. Ventral abdominal segments 2-5 dark brown, 6 and 7 yellow and luminous, 8 white, translucent, and with posterior margin notched. Pygidium pale and translucent, and truncate; other tergites dark. Aedeagus as in *consanguineus* (Green, 1956, Fig. 17). Flash pattern a single moderately short flash emitted at 4-6 sec intervals.

Type Locality—Superior Township, Washtenaw Co., Michigan, 6800 Warren Road, 27 June, 1966, J. E. Lloyd. Marsh. My No. 66390 deposited in the collection at Cornell University; C. U. Type No. 4501.

Variation—Length, 5.8-8.9 mm. ($\bar{x} = 7.7$, $n = 31$). Brown pigment of pronotum varying in density and distribution from barely noticeable to conspicuous and occluding completely the pink maculae of disk.

Females—Length, 5.6-7.4 mm. ($\bar{x} = 6.7$, $n = 11$). Form less elongate than males'. Similar to males in color. Pink pigment of pronotum variably occluded as in males but commonly splashed upon pronotal flange. Eyes small, separated medially above by more than diameter of eye. Ventral abdominal segment 6, yellow and luminous in median two-thirds of width; segments 2-5, 7 and 8, brown. Pygidium brown and narrowly rounded. Female flash response a single flash emitted about two seconds after male flash at temperatures near 70°.

Notes—This species is named for its northern distribution (Fig. 9). In recent observations of the fireflies of Nova Scotia, L. Buschman has observed and collected *aquilonius* and recognized it as an unnamed species, (pers. comm.). I have been unable to locate two specimens noted by Green (p. 606) from Illinois and Indiana, and the LeConte *ardens* series includes one example. *P. aquilonius* is similar to *obscurellus* and *ardens* in appearance since it has brown pronotal pigmentation, but is smaller and more narrowly elongate. Undoubtedly other specimens will be found in series now identified as *ardens*.


○ ignitus
● aquilonius

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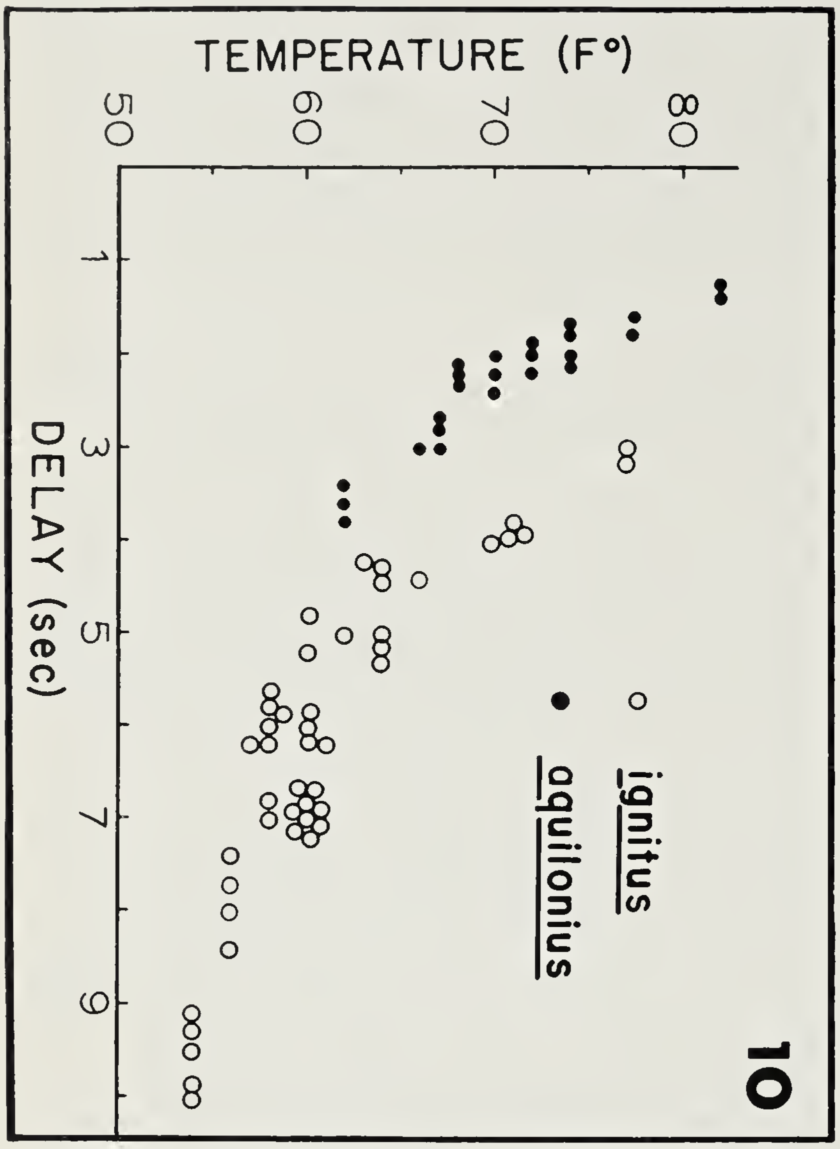
TEMPERATURE (F°)
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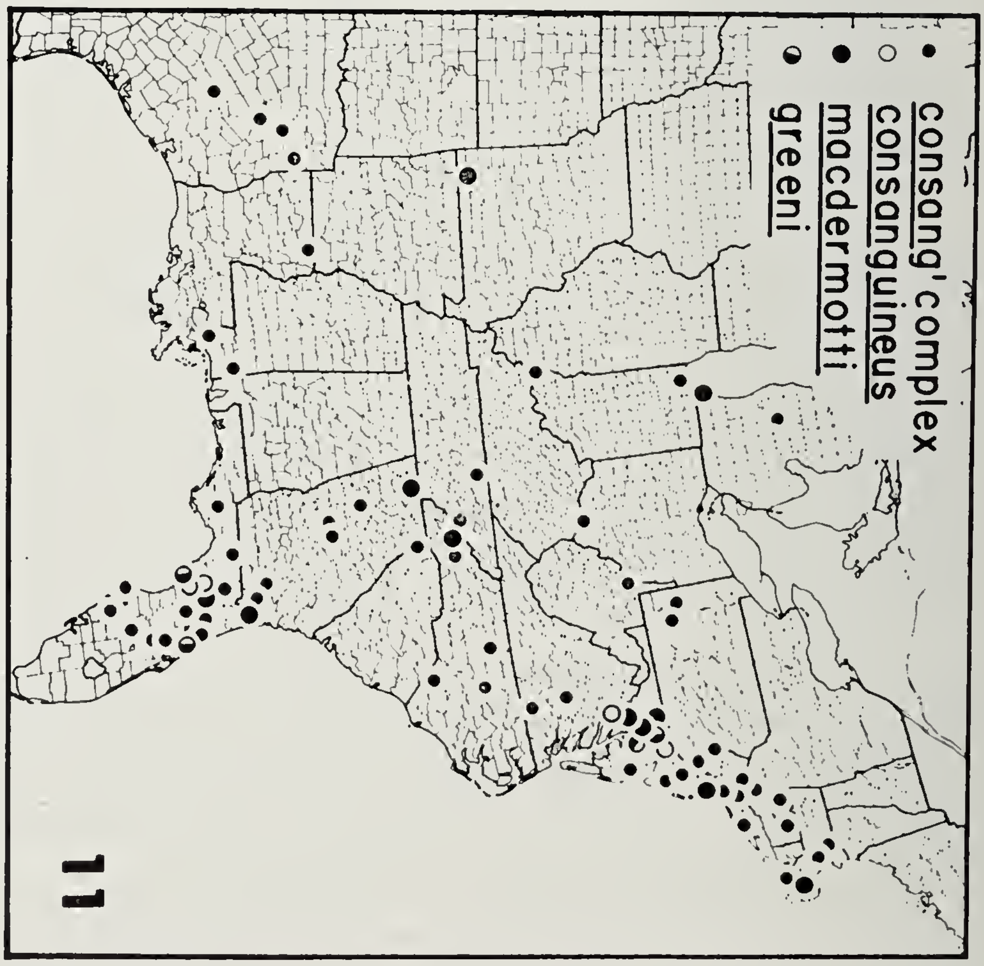
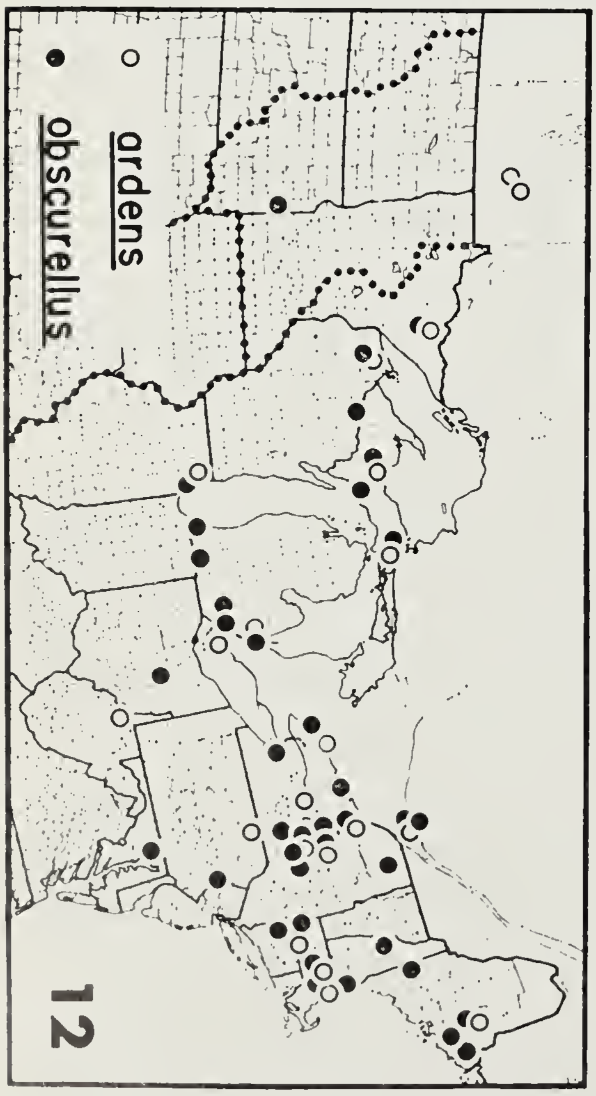
DELAY (sec)
○ ignitus
● aquilonius

10


• consang' complex
○ consanguineus
● macdermotti
◐ greeni

11


○ ardens
● obscurellus

12

Figures 9-12.— Fig. 9. Geographic distribution of *ignitus* and *aquilonius*. *P. aquilonius* is also known from Lunenburg, Nova Scotia. *P. aquilonius* specimens were found in the following collections; CNC, UMMZ, MCZ, USNM, CNHM, CAS and L. Buschman; Fig. 10. Female delay in *ignitus* and *aquilonius*. Females were placed on warm hood of automobile or pilot light of stove for several minutes to obtain reading above 75°. The variation noted at low temperatures may be partially due to difficulties encountered in obtaining accurate temperature readings in the field and broad humidity differences; Fig. 11. Geographic distribution of members of the *consanguineus* complex. Specific determinations based on flash behavior; Fig. 12. Geographic distribution of *ardens* and *obscurellus*. Dotted lines indicate limits of former political Territories. Eastern line indicates eastern limit of Missouri Territory to 1821. Western line indicates western limit of states and organized territories when LeConte named the two species. Area north of horizontal, and the NE triangular projection (Minn.), were then included in Minnesota Territory. *P. ardens* is known also from Lunenburg, N. S., and *obscurellus* from Debert, N. S., and Terre Nueve, Newfoundland. Specimens were found in the following collections: CU, CNHM, USNM, CAS, MCZ, CNC, L. Buschman. (Note added in press: A population of *P. ignitus* has been found in Gainesville, Florida.)

Photinus greeni Lloyd, NEW SPECIES

Behavior—A few individuals of this species were found at the type locality near New Smyrna Beach, Florida, on September 18, 1967, and May 3, 1968, and near Grasonville, Maryland, June 28, 1968. Single males were seen in Baltimore Co., Maryland, and Levy Co., Florida. The Grasonville site was a mixed woods (pine, sweet-gum, sumac, oak) adjacent to a salt marsh on Cabin Creek. The dominant plants of the N. Smyrna Beach site were palmetto, wax-myrtle, and marsh-elder.

The flash pattern is composed of two pulses at intervals of about 1.2 sec (timed intervals = 1.2, 1.1, 1.3, 1.2, 1.3, 1.2, 67°, Md.). The interval between flash patterns is 4-5 sec at this temperature. Pulse duration is about 0.2 sec (75°) (Fig. 8).

Three females were found by their flashed answers to artificial flash patterns (N. Smyrna B.). At 75° female delay is about one sec (Fig. 8), similar to that of *macdermotti* and *consanguineus* females. The single male tested in the field (Md.) was attracted to a flashlight when flashed in a manner simulating the response of females.

In the laboratory, caged females (N. Smyrna B.) responded to artificial flash patterns and discriminated differences in pulse interval. Discrimination tests were similar to those previously used with *macdermotti* and *consanguineus* females (1966a). Artificial 2-pulse flash patterns with various pulse intervals were presented randomly. Intervals in the range of *consanguineus* (ca. 0.4-0.6) and of *macdermotti* (ca. 1.6-2.4) were never answered. At 74° the lower cutoff or region of ambiguity (one female) was established by several stimuli and was between 0.92 and 0.97 sec. The upper cutoff was between 1.2 and 1.3 sec. At 75-76° intervals between 0.88 and 0.93 sec were answered.

When caged males were placed so they could see artificial flashes *and* female responses, they would sometimes flash with the artificial light on the second pulse of subsequent flash patterns. I recorded several sequences in which the artifical flasher, a male and a female all participated (Fig. 8).

Males were not stimulated to flash when they saw artificial flash patterns without female responses but males sometimes could be stimulated to join in flashing after seeing artificial flashes that simulated male and female interactions.

HOLOTYPE—Male. Form as in *ignitus*, generally more elongate than *consanguineus* or *macdermotti* (Lloyd, 1966b). Length 6.3 mm. Eyes large, separated medially above by less than diameter of eye. Pronotum with well-defined black, median, vitta and lateral, bright pink maculae; with slight median longitudinal depression. Scutellum and mesonotal sclerites brown. Elytra black; sutural bead pale, continuously around apex; lateral pale margin wider than flange anteriorly. Coxae and legs brown, femora pale basally. Ventral thoracic segments brown. Mesepimeron and -episternum with pink and mahogany areas. Ventral abdominal segments 2-5 brown with lateral margins irregularly bordered with mahogany; segments 6 and 7 yellow and luminous, and segment 8 pale yellow and white. Pygidium brown, rounded. Aedeagus as in *macdermotti* and *consanguineus*. Flash pattern of two short flashes about one sec apart at temperatures near 70°; repeated every four to six sec of flight.

TYPE LOCALITY—One mile north Turtle Mound, Route A1A, south of New Smyrna Beach, Volusia Co., Florida, September 18, 1967, J. E. Lloyd. Sand spit; palmetto and other dense scrubby vegetation. My No. 67539. Deposited in the collection at Cornell University; C. U. Type No. 4502.

VARIATION—Length, 6.3-11.3 mm. ($n = 9$ $\bar{x} = 8.4$) Pygidium round, subtruncate or truncate. Pronotum with or without median longitudinal depression; with or without median longitudinal sulcus or carinula. Pro- and mesocoxae pale or with pale areas; hind femora brown basally. Ventral thoracic segments and sclerites without pink or mahogany coloration.

FEMALES—Length, 6.0-6.6 mm. ($n = 3$). Similar to males in form and coloration. Eyes small, separated medially above by more than diameter of eye. Ventral abdominal segments brown with pink, mahogany or tan areas. Ventral segment 6 yellow and luminous in median third of width.

NOTES—The distribution of *greeni* and other species in the complex is given in Fig. 11. *P. greeni* is named in honor of the late John Wagener Green.

LeConte named *P. consanguineus* and *P. vittiger* in 1852. Motschulsky (1854) transferred *Lampyris vittiger* Gyllenhal (1817) to *Photinus*, thus making *vittiger* LeConte a junior, secondary homonym. *P. vittiger* Gyll. was later moved to *Pygolampis* and then to *Robopus*. Gemminger (1870) proposed the name *zonatus* to replace *vittiger* LeC. Both *vittiger* LeC. and *zonatus* have since been listed as synonyms of *consanguineus*. LeConte (1881) gave *vittiger* LeC. as a preoccupied name and synonym of *consanguineus;* he also gave *zonatus* Gemm. as a synonym of *consanguineus* and a "nomen superfluum." Green (pers. comm.) believed that LeConte gave the name *consanguineus* to replace *vittiger*. This cannot be the case since both were described at the same time (LeConte, 1852), but apparently LeConte eventually concluded that *consanguineus* and *vittiger* LeC. were not different taxa.

I have again examined the eleven specimens now in the *consanguineus* series in the LeConte collection. No. 1 is the "nomenifer" I designated previously (1966b). This is probably not the original type specimen. It is labelled "W. Va." (West Virginia?). West Virginia is not one of the "southern states," *consanguineus*' type locality, and was not established as a state until several years after *consanguineus* was named. Nos. 2-5, presumably conspecific with No. 1, are also labelled W. Va.; 2, 3 and 5 are females and 4 is a male. No. 6 is labelled "Pen" (Pennsylvania?) and although in the *consanguineus* group, it appears to be *P. ignitus* Fall. Nos. 7, 8 and 10 are tagged with orange disks (= locality, perhaps Southern States or Texas); specimen 7 is a male and 8 a female, both presumably of the *consanguineus* complex, and specimen 10 a female and possibly *P. consimilis* Green. No. 9 is the *vittiger* type with no locality; LeConte gave Georgia as the type locality. No. 11 is a male *consimilis* from F (ort) Capron, Florida.

It is not possible to separate members of the *consanguineus* complex (*consanguineus, macdermotti, greeni*) (see below) from various localities by morphological characters, although *consanguineus* and *macdermotti* from Gainesville can be distinguished. I previously associated the name *consanguineus* with the one-half sec flash pattern (1966b) since Gainesville members of this taxon more closely resembled No. 1 of the MCZ series than did those of the Gainesville two sec flasher (*macdermotti*). The *vittiger* type specimen agrees well with the *consanguineus* nomenifer and Gainesville one-half sec flashers.

Hence, *vittiger* LeConte and *zonatus* Gemminger are considered to be a synonym of *consanguineus; consanguineus* is left without a formal type specimen; and determination of species in the *consanguineus* complex, in most cases, is possible only through observation of flash behavior (see below).

Photinus macdermotti **Lloyd**

I have previously described the mating signals and behavior of this species (1966a), but in the summer of 1968 in Baltimore Co., Maryland, and Ocean Co., New Jersey, I observed behavior not seen at other localities (i. e. Georgia, Florida, Missouri, South Carolina).

The flash pattern of *macdermotti* is composed of two pulses with an interval of about 2 sec. Flash pattern interval in the southern populations is from 4-6 sec, hence the intervals between consecutive flashes (not flash patterns) would be approximately 2, 4, 2, 4, etc. sec. In the Maryland and New Jersey populations almost all individuals phrased their flashes 2, 2, 2, etc. sec. Actual measurements: male No. 1: 2.2, 2.4, 2.3, 2.4, 2.4, 2.4, 2.4, 2.4, 2.4 (72°, stopwatch); male No. 2: 1.74, 1.81, 1.78, 1.80, 1.76, 1.78, 1.77, 1.78, 1.75 (75°, electronic). The other phrasing (i. e. 2-4-2) was observed in Maryland males flying at high altitudes among tree branches after the main period of flashing activity. The flashes of some Maryland males appeared to twinkle, that is, they appeared bimodal, but this was not confirmed by electronic recording.

The female response in *macdermotti* is a single flash emitted about one second after the second pulse of a male phrase. When Maryland males received such a response from a female or an artificial light they either continued 2-2-2 or began 2-4-2 phrasing as they approached the female or decoy. Of those that began 2-4-2, when a flash response did not follow the next -2-, they continued without pause 2-2-2 until another response was flashed.

Several *macdermotti* females were collected at this site and their responses to artificial and actual flash patterns noted. In general, they flashed their species-specific response (1) after isolated single flashes that were presented at very long intervals (1 + minutes), (2) after the species-specific pulse pair in 2-4-2 sequences, and (3) after various, sometimes consecutive, pulses of 2-2-2 sequences. These females would not answer two-pulse phrases with contained intervals of one second (*greeni* flash pattern).

Another behavioral difference noted in Maryland *macdermotti* was that male flashing activity began about 15 minutes before sunset (versus 8-12 minutes after sunset in Florida populations). This difference would appear to be larger than can be accounted for by latitudinal twilight variation or observed differences in shading or vegetation density.

While it is possible that this species is not *macdermotti* but instead a new species, the observed differences, given sympathy, would not reproductively isolate these fireflies from "typical" *macdermotti.*

TAXONOMIC NOTES AND A KEY

Green (1956) recognized five species in the *consanguineus* group; four from eastern United States and one, presumably a Mexican species, from Arizona. Since then, through behavioral studies, I have found three additional species. I have not found morphological characters that will consistently separate four of the eight species; these, *consanguineus, macdermotti, ignitus,* and *greeni,* are keyed (below) morphologically to *"consanguineus* complex," and then behaviorally to species. It is likely that there are more species in this group. McDermott (1948, p. 14) reported the presence of a single-flash *"consanguinus"* (*macdermotti, ignitus?*) in Wilmington, Delaware, and Martha's Vineyard, and a 2-4 pulse species in Boston. In Charles Co., Maryland, in June, 1968, I observed two individuals emitting 2-3 pulse phrases each 4-5 sec with 0.4-0.5 sec between pulses. At this same site, a ravine near the Potomac River Bridge at Rt. 301, I also observed two-pulse phrases with pulse intervals of approximately 0.7 sec (80°). Green (1956, p. 606) noted the presence of "darkly pigmented individuals . . . with the lateral pale border of the elytra narrow . . . " and also "undersized examples." Green (p. 603) also mentions a specimen labelled Sand Hills (Franklin Co.?), Nebraska, that appeared much like Florida's *linecllus;* this may have been *aquilonius* n. sp. or yet another species.

KEY TO MALES OF THE CONSANGUINEUS GROUP

1. Locality southern Arizona; lateral lobes of aedeagus tapered (Fig. 16, Green, 1956) .... **knulli**
Locality eastern and midwestern states; lateral lobes of aedeagus rounded (Fig. 17, Green, 1956) 2
2(1). Light organ absent (ventral abdominal segments entirely black or dark); ventral segments 6 and 7 each sub-equal in length to segment 5[2]; eyes small, separated medially above by more than diameter of eye .... **indictus**
Light organ present (ventral segments 6 and 7 yellow); ventral segments 6 and 7 each longer than 5; eyes large, separated medially above by less than diameter of eye 3
3(2). Pygidium pale, sharply contrasting with preceding dark tergites 4

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[2] Ventral abdominal segment 5 = apparent segment 4 in nearctic *Photinus* except *granulatus* LeConte females.

Pygidium dark, concolorus with preceding dark tergites 5

4(3). Locality southeastern United States (Florida, Georgia, Alabama); pronotum with lateral pink or red maculae bright and conspicuous .... **lineellus**

Locality northern United States (Michigan, Minnesota, Maine), and Canada (Fig. 11); pronotum with lateral pink or red maculae dulled or occluded by brown or dark pigment .... **aquilonius**

5(3). Elytra brown; pronotal vitta variable, a well defined or diffuse stripe or spot, and occasionally absent; scutellum pale at tip .... **ignitus** 6

Elytra black; pronotal vitta a vivid, shiny black stripe or rectangle and always present; scutellum black throughout .... **consanguineus** complex 6

6(5). Flashes single 7

Flashes paired (though not always conspicuously so) 8

7(6). Single flash repeated each 4-6 sec[3] while flying .... **ignitus**

Single flash repeated each 2 sec while flying (see text) .... **macdermotti**

8(6). Two flashes of the pair not obvious or conspicuous **as a pair.** (The interval separating the two at least 1.6 sec in duration; consecutive flash intervals measure about 2, 4, 2, 4 etc. sec in duration)[3] .... **macdermotti**

Two flashes of the pair obvious and conspicuous **as a pair.** (They are emitted close together, less than 1.3 sec apart) 9

9(8). Interval between the two flashes of the pair about one-half sec in duration (consecutive flash intervals measure about 0.5, 4, 0.5, 4, etc. sec in duration) .... **consanguineus**

Interval between the two flashes of the pair about one second in duration (consecutive flash intervals measure about 1, 4, 1, 4, etc. sec in duration) .... **greeni**

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[3] Interval measurements given in key are for temperatures near 70° F; at higher temperatures intervals will be shorter, and at lower temperatures they will be longer.

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On *Podabrus parvicollis Motschulsky*[1] (Coleoptera: Cantharidae)

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This is an attempt to ascertain and explain what Motschulsky had when he defined his *Podabrus parvicollis.* For some reason past students have neglected it entirely or assigned it as the synonym of the first species available, without much seeming interest in what species he actually possessed.

Motschulsky (1859) described *Podabrus parvicollis* from Pennsylvania, offering a number of salient features: Pronotum transverse, narrowed in front and margined with pale testaceous; elytra widened apically, the costae distinct; the knees yellowed on all the feet.

LeConte (1881) placed *P. parvicollis* as a synonym of *Podabrus diadema* Fabricius, with no indicated reason.

Leng (1920) followed LeConte apparently accepting his (1881) work.

Fall (1928), in a systematic review of *Podabrus,* neglected to recognize a number of names previously placed in synonomy, although he resurrected a few. Among those he neglected was *P. parvicollis.*

Green (1947) showed the impropriety of association of *P. parvicollis* with either *P. diadema* or *Podabrus planulus* Green, neither of which have ever been seen with pale knees. He apparently never pursued the problem further, sort of leaving *P. parvicollis* in the state of limbo.

As stated by Green, no specimen of either *P. diadema* or *P. planulus* has

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[1] This study was supported by National Science Foundation Grant GB-6283X.

ever been seen in which the knees are yellowish. Too, neither of these species has the pronotum appreciably narrowed anteriorly, nor the elytra widened apically and the costae more distinct.

I have representatives of two species of *Podabrus* in which the knees are yellowish. One is an undescribed species in which the pronotum is not appreciably narrowed anteriorly, the elytra not apically widened and the costae not more distinct than usual. These things remove this species from consideration.

Podabrus rugosulus LeConte (*P. rugulosus* of Leng and Fall) has the pronotum notably narrowed, the elytra widened apically and the costae rather strongly marked. The legs are more often than not black but may have some portion thereof pale (i. e., yellowish). In a large random selection from the American Museum of Natural History, the following ratios occurred: Legs all black (52%); knees of all feet yellowish (13%); all knees yellowish and protibiae light brown (10%); knees, tarsi, and protibiae pale (3%); knees of prolegs pale (2%); all knees and tarsi and tibiae of front and middle legs pale (2%); all knees, protibiae, and protarsi pale (2%); protibiae and protarsi pale (2%); prolegs pale brown (2%); profemora, protibiae, and basal segments of tarsi pale (2%); knees, protibiae, basal two protarsal segments, and antennae pale (1%); protibiae and apical two-thirds of profemora pale (1%); protibiae and apical third of profemora pale (1%); all knees and prolegs beneath pale (1%); knees of prolegs only pale (1%).

The group with the legs bicolored seems to be most abundant in the Pennsylvania, New York, and New Jersey area although not necessarily confined thereto. Black-legged specimens are found throughout these three states. Nine specimens from Connecticut all had black legs. Specimens from Maine were all black legged. Eleven specimens from Black Mountains, North Carolina had the legs all black while one had all the knees pale.

The second group (all knees yellowish) is, I am certain, what Motschulsky must have had before him and called *P. parvicollis*. Hence that name should be removed as a synonym of *P. diadema* and made a synonym of *P. rugosulus*.

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Additions to the Horned Bark Beetle Genus *Cactopinus* Schwarz (Scolytidae)

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The monobasic bark beetle genus *Cactopinus* Schwarz (1899:11) was described to include the remarkable, horned *C. hubbardi* Schwarz. A revision by Blackman (1938) increased the number of known species to four. Three species were added (Wood, 1957, 1967) prior to the review by Bright (1967) which brought the number of species to nine. In his review Bright subdivided the genus by erecting a new genus, *Cactopinorus,* for *cactophthorus* Wood and *mexicanus* Wood, on the basis of the more widely distributed pronotal asperities and angulate or bisinuate sutures of the antennal club.

In the summer of 1967, the opportunity came for me to collect in south-central Mexico where several species of giant cactus occur. From that area, long series of three previously described species and five species of *Cactopinus* new to science were collected and observed. After examining all fourteen species in detail it was quite clear that *Cactopinus* is a monophyletic genus of perhaps great antiquity within the Scolytidae. Although the characters used to divide the genus by Bright, including the pronotal asperities and sutures of the antennal club, represent extremes within the genus their expression was not correlated with one another, nor did I see a distinct break within the group, based on these or other characters, that would justify the recognition of more than one genus or subgenus. *Cactopinorus* Bright, therefore, is a junior synonym of *Cactopinus* Schwarz.

In my key to the genera of North American Scolytidae (Wood, 1961:44), *Cactopinus* was placed in the tribe Micracini. After examining several thousand examples of Micracini and a thousand specimens of *Cactopinus,* new significance was seen in several characters not appreciated earlier. Except on the epistomal brush all setae on *Cactopinus* species are simple and hairlike; they are subplumose or fimbriated on the head and at least part of them are flattened or scalelike on the pronotum and elytral interstriae in the Micracini. In *Cactopinus* the front coxae are contiguous; they are separated by an intercoxal piece in all but the most specialized Micracini. The antennal funicle of *Cactopinus* is 5-segmented; it is 6-segmented in the Micracini. The anterior tibiae are more nearly similar to the Hexacolini than to Micracini. The scutellum in *Cactopinus* is very different from that of the Micracini. While the epistomal armature of *Cactopinus* is unique it probably will not stand as a distinguishing tribal character. The genus should be placed in the tribe Cactopinini Chamberlin (1939) evidently near the Micracini.

The species of *Cactopinus* evidently are highly host specific. Eight of the 14 known species were collected from various species of giant cactus, one from leaves of a very large species of *Yucca,* two from species of *Pinus,* one from species of *Rhus,* and two from species of *Bursera.* One of the *Bursera* inhabiting species, *spinatus* Wood, also occurred in two other unidentified broadleaf tree genera. Except for *granulifer* Wood, which was collected in series with *microcornis* Wood and *nasutus* Wood, each of the species from giant cactus appeared to be taken from a different host species. *Carnegia gigantea,* for *hubbardi* Schwarz, is the only cactus host definitely associated with a bark beetle; however, it is quite probable that *Pachycereus pecten-aboriginum* is the host of *mexicanus* Wood.

All of the species are monogamous. A simple, elongate, cave-type tunnel is constructed within the host tissues; rather large egg niches are placed at somewhat irregular intervals along the margins. Very little effort is made to remove frass from the parent galleries. The adult beetles wallow in the frass and commonly are completely covered by an incrustation formed largely from the frass. Under these circumstances the sexes evidently experience some difficulty locating one another. Presumably, the male uses his horn, which is equipped with sensory hairs near its tip, as a probe to grope through the frass to locate his mate.

Seven of the eight species from giant cactus breed in cut or damaged arms in dead, drying tissue immediately below the yellow epidermis. In the laboratory several successive generations have been produced from the same small piece of pathetically dry cactus. This supports the supposition that under field conditions an infestation may continue in a suitable piece of host material for an unusually long period of time. The eighth species, *hubbardi,* breeds in scar tissue, such as that found lining woodpecker nests, deep inside of living host plants.

The diversity of the genus and the apparent availability of more than 30 species of suitable cactus hosts in Mexico alone, not to mention other potential hosts or areas, suggests that many more species will be added to the genus in the future.

KEY TO THE SPECIES OF *Cactopinus*

1. Body stout, less than 2.0 times as long as wide; male epistomal horns widely separated, the space between them at least as wide as one horn; antennal club large, circular, the sutures procurved; strial punctures coarse and very deep 2

Body more slender, more than 2.2 times as long as wide; male epistomal horns contiguous at least on basal half; antennal club small, oval to large, circular, the sutures either straight or procurved; strial punctures smaller, usually not as deep 3

2(1). Male frons shallowly concave, its upper margin rounded; male horns very short, their height usually not greater than their basal width; lateral convexities on elytral declivity moderate, with striae 2 clearly marked before summit; interstrial nodules on disc continue to base of elytra; Oaxaca; 1.5-1.9 mm (Figs. 1-2) .... **microcornis** Wood

Male frons broadly, deeply concave, its upper margin abrupt; male horns each three or more times longer than its basal width; lateral convexities of elytral declivity abruptly, strongly elevated, striae 2 obsolete toward summit; interstrial nodules obsolete on basal half of disc; Jalisco; 1.3-1.6 mm (Figs. 3-4) .... **mexicanus** Wood

3(1). A majority of pronotal asperities on anterior half, including anterior fourth; posteromedian area of pronotum weakly conical, usually not projecting behind posterior margin; pronotal asperities irregular in size, mostly fine, close, abundant; male frons deeply, broadly concave (except excavated but transversely flat to feebly concave in **cactophthorus**) 4

A majority of pronotal asperities on posterior half, the anterior fourth usually unarmed;

posteromedian area of pronotum strongly projecting over scutellum; pronotal asperities coarse, isolated, comparatively sparse; male frons transversely flat or convex 10

4(3). Pronotal asperities more widely distributed, supplemented in lateral areas by rounded granules extending to lateral margins; posteromedian margin of pronotum narrowly elevated into a small cone projecting very slightly above scutellum; body never covered by an incrustation 5

Pronotal asperities more narrowly distributed on posterior half, the lateral areas devoid of granules; posteromedian area not narrowly elevated or produced into a cone; body usually largely covered by an incrustation 9

5(4). Antennal club rather small, distinctly longer than wide, the sutures straight; male frons more narrowly excavated, the upper half not wider than distance between eyes (except **cactophthorus**); usually smaller, 1.2-1.9 mm. 6

Antennal club rather large, about as wide as long, the sutures rather strongly, subangulately procurved; upper half of male frontal excavation distinctly wider than distance between eyes; usually larger, 1.3-2.3 mm. 8

6(5). Male frons strongly excavated but transversely almost flat, the anterior margin of eye touching excavation when viewed from lateral aspect; frontal horn of male longer than median length of frontal excavation; strial punctures slightly smaller, not as deep; interstriae slightly wider, the punctures fine, somewhat confused; Puebla; 1.2-1.4 mm. .... **cactophthorus** Wood

Male frons more narrowly concave, anterior margin of eye not reaching excavation when viewed from lateral aspect; frontal horn of male much shorter than length of frontal excavation; strial punctures slightly larger, deeper; interstriae narrower, the punctures somewhat coarser, usually uniseriate 7

7(6). Discal interstriae uniseriately punctured to margin of declivity; Oaxaca; 1.6-1.9 mm. (Figs. 5-6) .... **niger** Wood

Discal interstriae uniseriately, closely, rather coarsely granulate on slightly less than posterior half; Oaxaca; 1.3-1.6 mm. (Figs. 7-8) .... **granulifer** Wood

8(5). Frons devoid of a median carina, sometimes feebly, obtusely raised in male; sutures of antennal club strongly, obtusely bisinuate; elytral punctures and pronotal asperities slightly larger, the posteromedian marginal cone on pronotum rather well developed; Puebla and Oaxaca; 1.4-1.7 mm. (Figs. 9-10) .... **nasutus** Wood

Upper half of frons bearing an acutely elevated median carina in both sexes; sutures of antennal club angulate, 1 acute (more pronounced in male); elytral punctures and pronotal asperities slightly smaller, the posteromedian marginal cone on pronotum poorly developed; Hidalgo; 1.5-1.8 mm. (Figs. 11-12) .... **carinatus** Wood

9(4). Strial punctures fine, shallow, the interstrial punctures minute, confused; declivity rather gradual, more narrowly sulcate above, the elytral apex narrowly rounded behind; lateral convexities of declivity entirely devoid of granules or teeth; in **Yucca** leaves; San Luis Potosi to Hildalgo; 1.3-1.5 mm. .... **depressus** Bright

Strial punctures rather coarse, deep; interstriae 1, 3 and 5 uniseriately granulate to base; elytra broadly rounded behind; declivity steep, rather broadly excavated, the lateral convexities each armed by about three to five coarse teeth; in **Bursera**, etc.; Jalisco to Oaxaca; 1.4-1.7 mm. .... **spinatus** Wood

10(3). Elytral declivity shallowly sulcate, the lateral convexities armed by minute granules; elytra rather narrowly rounded behind; male horn shorter than half length of pronotum; body slender, more than 2.5 times as long as wide 11

Elytral declivity rather deeply sulcate, the lateral convexities armed by small to very large denticles; elytra very broadly rounded behind; male horn usually longer than half length of pronotum 12

11(10). Elytral declivity not sulcate except for feeble impression on interstriae 1, interstriae 1-3 not granulate; in **Pinus** spp.; Utah to southern California; 1.5-1.7 mm. .... **koebelei** Blackman

Elytral declivity shallowly sulcate, interstriae 1-3 uniseriately, coarsely granulate; in **Rhus diversalobata** and **trilobata**; southern California; 1.3-1.8 mm. .... **rhois** Blackman

12(10). Body slender, 2.6 times as long as wide; sulcus extending anterior to declivital base between sutural striae; lateral convexities of declivity armed by fine, rounded granules; setae on sides of elytra very long, coarse; in **Pinus jeffreyi**; southern California; 1.6-2.0 mm. .... **pini** Blackman

Body stout, 2.4 times as long as wide; sulcus not extending anterior to declivital base; lateral convexities of declivity armed by pointed denticles 13

13(12). Declivital interstriae 3 armed by small, pointed denticles; declivital sulcus deeper, narrower; antennal club larger, at least three times as wide as last funicular segment, 1.1 times as long as wide; in **Carnegia gigantea**; southern Arizona; 1.6-2.3 mm. .... **hubbardi** Schwarz

Declivital interstriae 3 armed by a row of about three to eight long, slender teeth; declivital impression almost flat; antennal club small, not more than twice as wide as last funicular segment, 1.3 times as long as wide; in **Bursera**; southern California; 1.6-2.1 mm. .... **desertus** Bright

Cactopinus microcornis n. sp.

This species is closely related to *mexicanus* Wood, but it is easily distinguished by characters summarized in the above key.

Male—Length 1.7 mm. (paratypes 1.5-1.9 mm.), 2.0 times as long as wide; color black.

Frons rather narrowly concave on median half, about two-thirds of concave area above upper level of eyes, lower area half way between epistomal margin and upper level of eyes armed by a pair of tubercles, distance between tubercles and height of each about equal to basal width of a tubercle; surface subreticulate, with rather sparse fine punctures; vertex rather coarsely rugose-reticulate; vestuture rather sparse, hairlike, abundant and coarse on epistomal margin. Antennal club circular in outline, the sutures moderately bisinuate.

Pronotum 0.89 times as long as wide; widest a third of length from base, the posterior two-thirds of sides very strongly arcuate, narrowly rounded in front; basal margin slightly produced behind in median area; summit on basal fourth; asperities begin on median third just behind anterior margin and extend to pointed posteromedian extremity projecting above scutellum, closely set but not high, the asperate area rather abruptly subinflated on posterior half; lateral areas almost smooth, with isolated, setiferous, rounded granules of moderate size; vestiture hairlike, rather sparse, of moderate length.

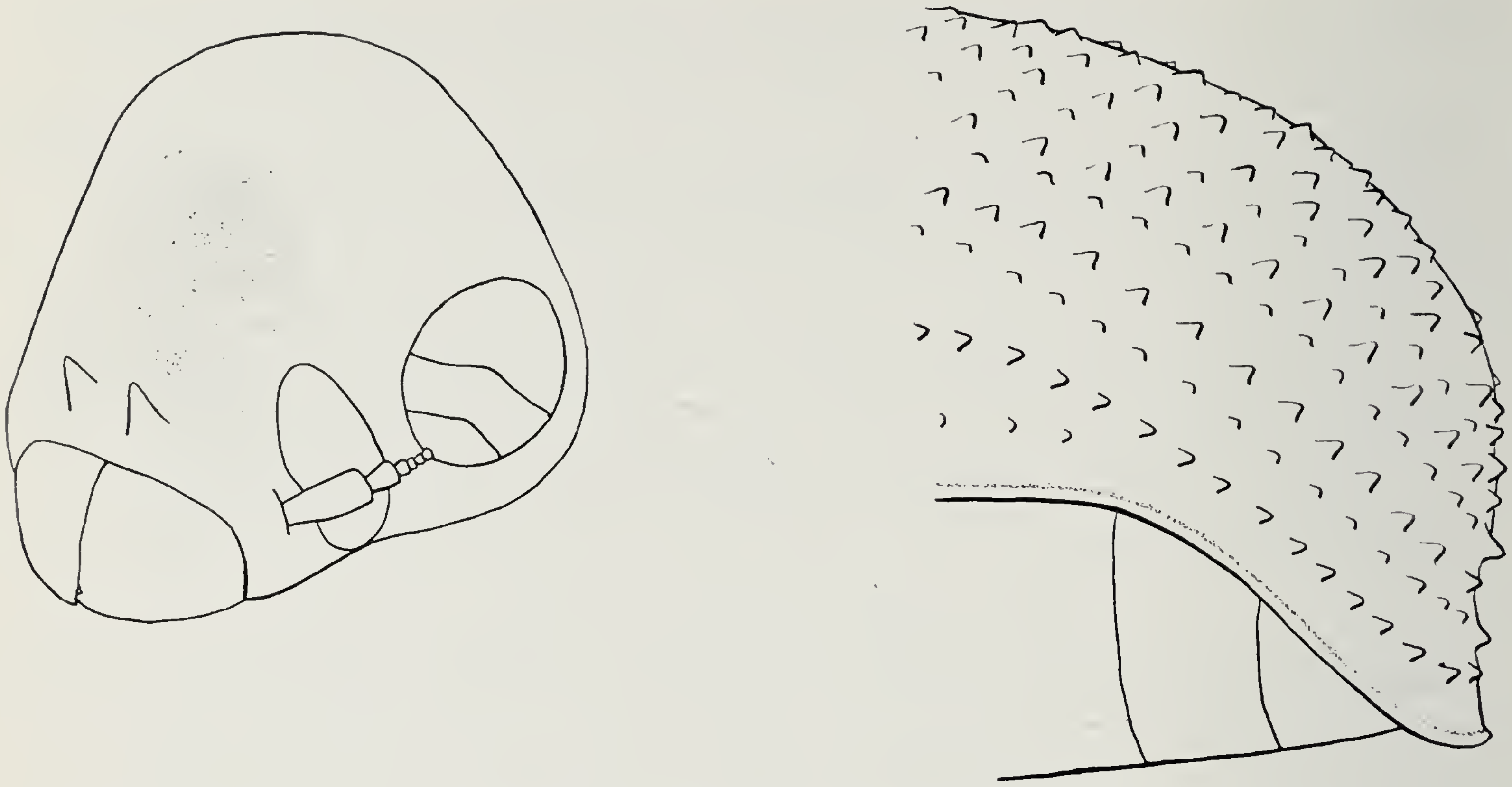
Elytra 1.2 times as long as wide, 1.3 times as long as pronotum; sides almost straight and parallel on more than basal two-thirds, broadly subemarginate behind; sutural striae feebly, others not at all impressed, the punctures coarse, deep, close; interstriae narrower than striae, uniseriately granulate to base, the nodules increase in height posteriorly. Declivity short, very steep, strongly sulcate; striae 1 rather strongly impressed; interstriae 1 moderately elevated, lateral areas ascending to broad summit on 4, tubercles absent on 1 and 2, of moderate size on 3 and 4, coarse on 5 to 9. Vestiture consisting of interstrial rows of moderately long hair on 3, 5, 7, and lateral areas, setae on other interstriae minute if present.

Female.—Similar to male except frontal concavity not as deep and extending further toward epistoma, the tubercles entirely absent; the elytral tubercles very slightly smaller.

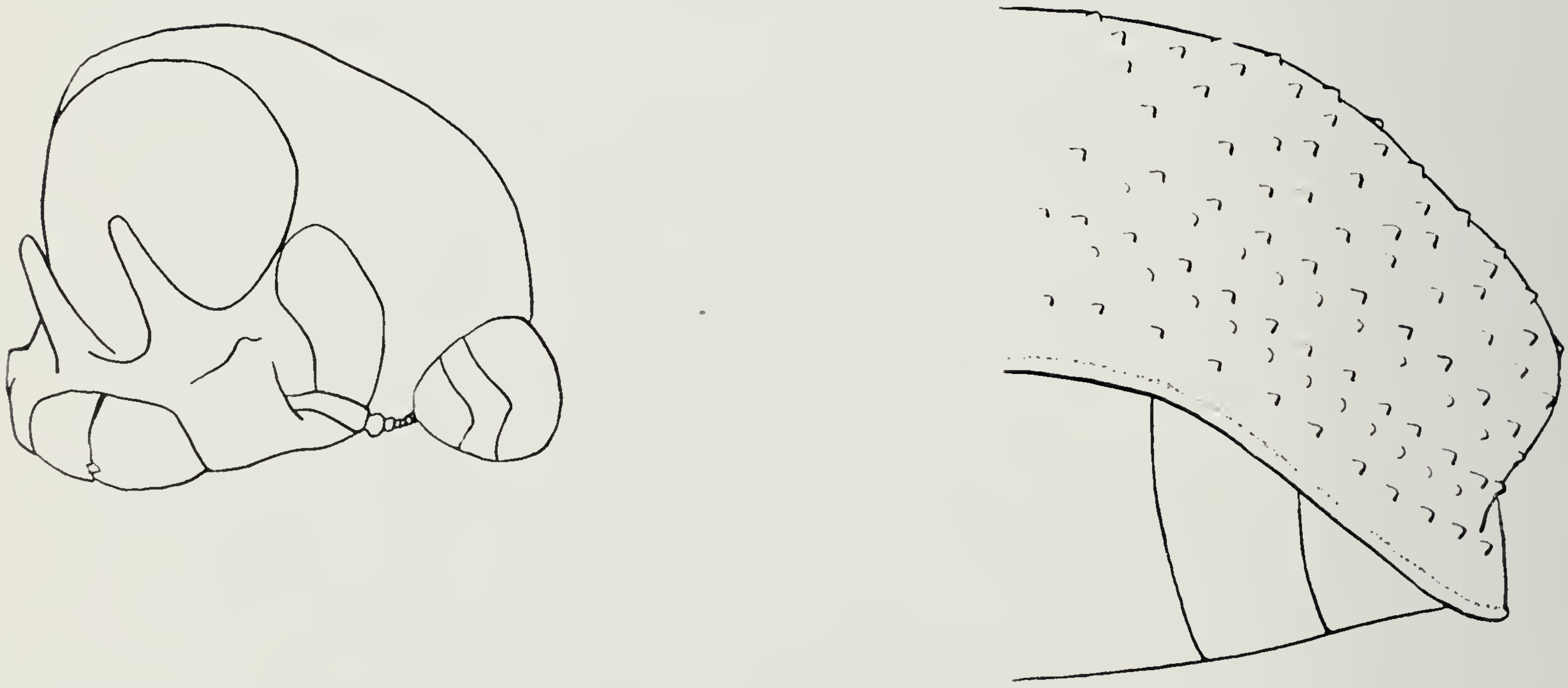
Type Locality.—Ten km. (6 mi.) south of Huajuapan, Oaxaca, Mexico.

Type Material.—The male holotype, female allotype and 41 paratypes were collected at the type locality on June 16, 1967, elevation about 2,000 m., No. 44, by S. L. Wood, in dying giant cactus; 15 additional paratypes were taken 32 km. (20 mi.) south of Huajuapan, No. 47, at the same date and elevation, from the same host. Both series were taken immediately below the epidermis in association with *granulifer*. When competing for space this species tended to occupy the summits of ridges near bases of the cactus spines. The beetles were in yellow, drying tissue of a cut arm of the large giant cactus.

The holotype, allotype and paratypes are in my collection.



Figs. 1-2. *Cactopinus microcornis,* male: 1, left, anterolateral aspect of head; 2, right, lateral aspect of elytral declivity.



Figs. 3-4. *Cactopinus mexicanus,* male: 3, left, anterolateral aspect of head; 4, right, lateral aspect of elytral declivity.

Cactopinus niger n. sp.

This species is rather closely related to *cactophthorus* Wood, but it is easily distinguished by characters summarized in the above key.

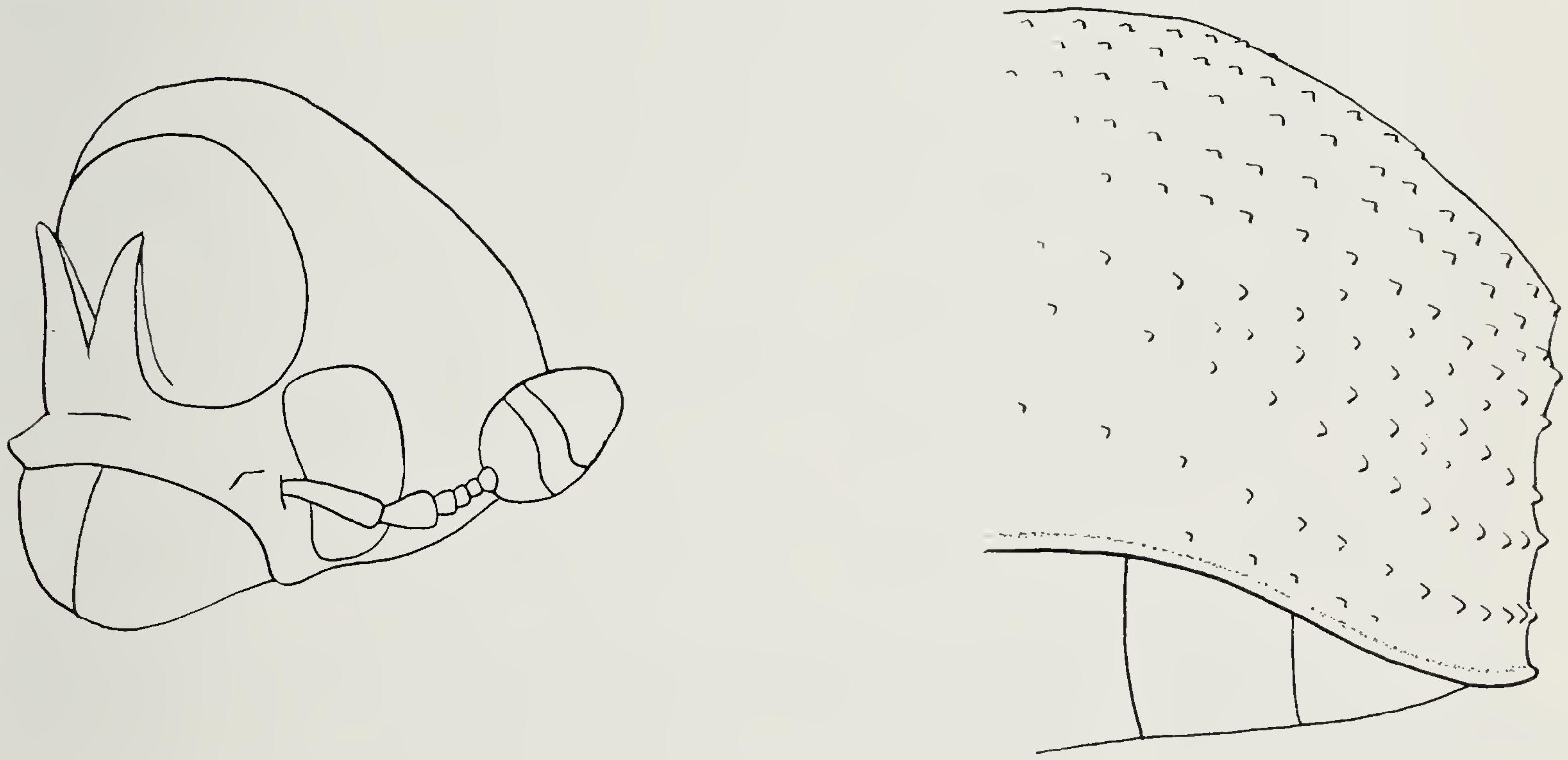
Male.—Length 1.7 mm. (paratypes 1.6-1.9 mm.), 2.3 times as long as wide; color black.

Frons deeply, broadly concave from base of horns to vertex, the upper margin acute; the basally contiguous pair of horns arise just above epistoma, fused on their basal half, diverging distally, their total length slightly less than distance equal to longitudinal axis of frontal concavity; lateral margins armed by a pair of small tubercles just above antennal insertion; surface of concavity smooth to subreticulate, with a few minute punctures, area above concavity rugulose-reticulate; vestiture of fine, short hair above horns, slightly longer on horns, much longer and somewhat reddish on epistomal margin. Antennal club rather small, oval, the sutures straight.

Pronotum 1.0 times as long as wide; widest on basal third, the sides moderately arcuate, distinctly constricted on anterior third, rather narrowly rounded in front; posterior margin produced behind in median area; asperate area beginning just behind anterior margin on median third, expanding toward sides toward middle, then narrowed to median process at base, not inflated laterally, the transition to asperate area gradual; lateral areas smooth, with isolated rounded granules, the granules transcend gradually into asperities above; vestiture hairlike, longer anteriorly.

Elytra 1.26 times as long as wide, 1.34 times as long as pronotum; sides almost straight and parallel on basal two-thirds, broadly subemarginate behind; striae 1 weakly, others not impressed, the punctures coarse, close, deep; interstriae smooth but undulating, the punctures uniseriate, moderately large, deep, their anterior margins slightly higher, a few weak granules toward declivity. Declivity short, steep, strongly, broadly sulcate; striae 1 strongly impressed on upper two-thirds; interstriae 1 slightly elevated, lateral areas ascend to broad summit on 4, lower fourth of 2 flattened, 3-9 each bearing a uniseriate row of moderately large, high, rounded tubercles. Vestiture consisting of a few short, intertrial, hairlike setae on declivity and sides.

Female.—Similar to male except frons feebly convex with a shallow impression on median third, the horns entirely absent.



Figs. 5-6. *Cactopinus niger,* male: 5, left, anterolateral aspect of head; 6, right, lateral aspect of elytral declivity.

Type Locality.—Thirty-two km. (20 mi.) south of Huajuapan, Oaxaca, Mexico.

Type Material.—The male holotype, female allotype and 80 paratypes were collected at the type locality on June 16, 1967, about 2,000 m., No. 46 by S. L. Wood, from a giant cactus having a distinct bluish color. They were taken from drying tissues just below the yellowing epidermis of a cut arm of the cactus.

The holotype, allotype and paratypes are in my collection.

Cactopinus granulifer n. sp.

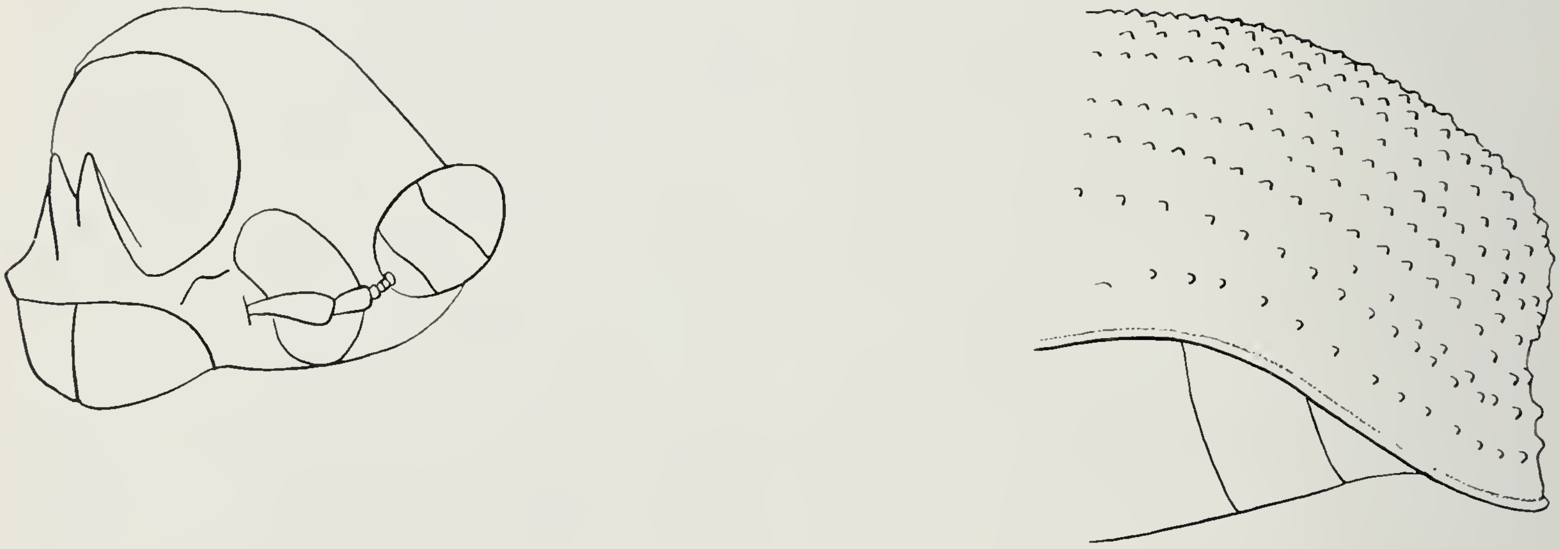
As indicated by the characters summarized in the above key this species is very closely related to *niger* Wood, described above.

Male.—Length 1.4 mm. (paratypes 1.3-1.6 mm.), 2.36 times as long as wide; color black. Frons deeply, broadly concave from epistomal horn to vertex, the upper margin abrupt, subacute; the epistomal horns similar to but smaller than in *niger,* about two-thirds as long as longitudinal axis of concavity; surfaces and vestiture as in *niger.* Antennal club rather small, subcircular in outline; suture 1 straight, 2 feebly bisinuate.

Pronotum 1.02 times as long as wide; as in *niger* except asperities begin well behind anterior margin and do not extend as far laterally, granules in lateral areas smaller and less abundant, intermixed with numerous, close, fine, deep punctures; vestiture hairlike, longer anteriorly.

Elytra 1.3 times as long as wide, 1.3 times as long as pronotum; outline essentially as in *niger;* striae 1 feebly, others not impressed, the punctures coarse, deep, close, with interspaces between punctures uniseriately granulate, the granules increasing in size posteriorly until almost as large as those of interstriae at declivital margin; interstriae narrower than striae, irregular, the uniseriate granules increasing in size toward declivity. Declivity short, very steep, broadly, deeply sulcate; general sculpture as in *niger* except lateral convexities higher, the granules higher, much more numerous (including those on striae), the granules reduced on striae 1 and interstriae 1 on lower two-thirds. Vestiture consisting of uniseriate rows of erect interstrial hair of moderate length, except minute on declivity.

Female.—Similar to male except frons weakly convex, with a slight transverse impression near upper level of eyes.



Figs. 7-8. *Cactopinus granulifer,* male: 7, left, anterolateral aspect of head; 8, right, lateral aspect of elytral declivity.

Type Locality.—Ten km. (6 mi.) south of Huajuapan, Oaxaca, Mexico.

Type Material.—The male holotype, female allotype and 37 paratypes were collected at the type locality on June 16, 1967, about 2,000 m., No. 44, by S. L. Wood, from the same piece of giant cactus that contained *microcornis;* 42 paratypes were taken 32 km. (20 mi.) south of Huauapan on the same day, No. 47, also in association with *microcornis;* 16 paratypes were taken 6 km. (4 mi.) north of Totolapan, Oaxaca, Mexico, June 20, 1967, 1,200 m., No. 67, by S. L. Wood. When *microcornis* was present this species tended to avoid the tops of ridges where thorns were located on the cactus and confined their attack to drying tissues just below the epidermis in the bottoms and sides of valleys between the ridges. A small sample of cactus was preserved to show the crude cave-type tunnels of this species. The sample was placed on a shelf where previously unobserved larvae matured and produced at least two additional generations in the same piece of cactus before the process was terminated by fumigation.

The holotype, allotype and paratypes are in my collection.

Cactopinus nasutus n. sp.

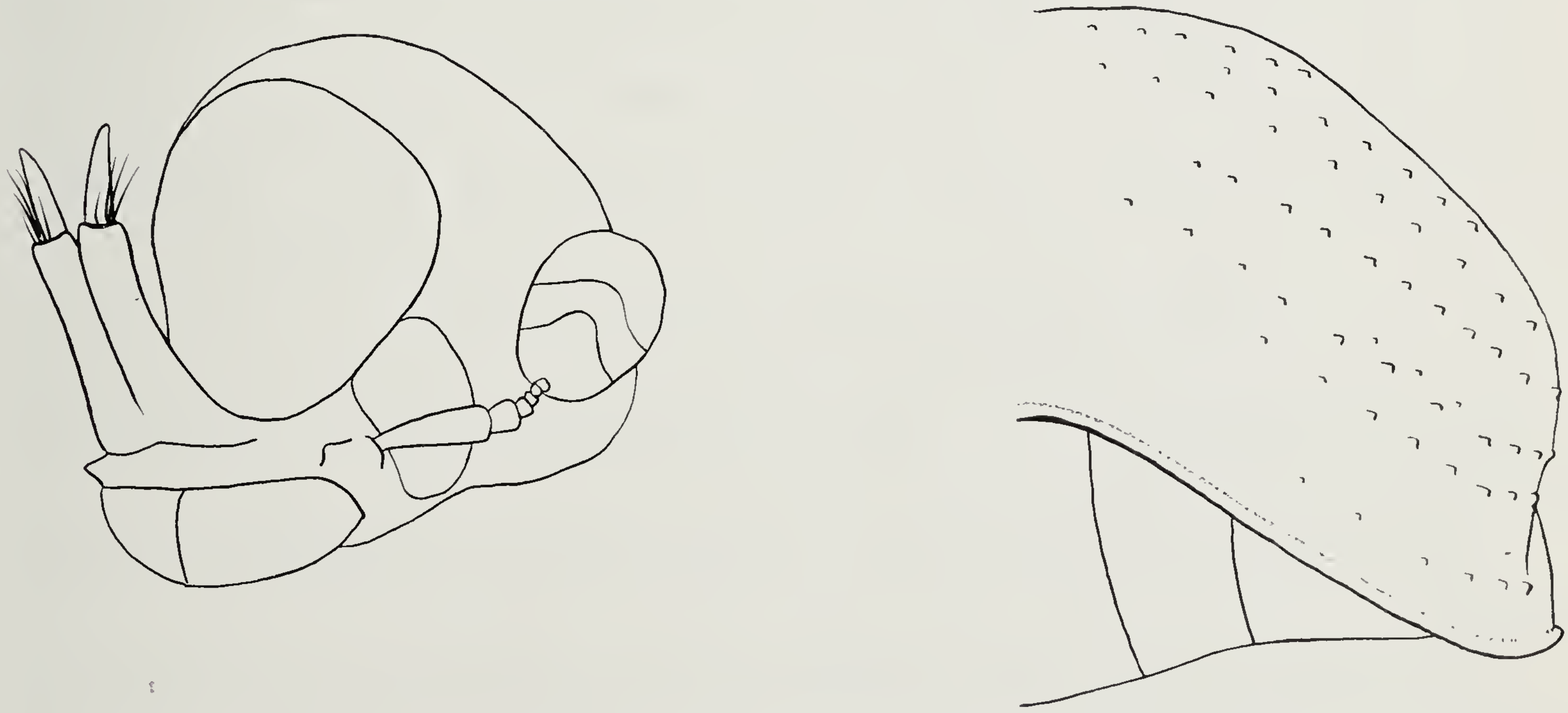
This species is allied to *cactophthorus* Wood, but it is easily distinguished by the broad antennal club which has bisinuate sutures, and by other characters summarized in the above key.

Male.—Length 1.6 mm. (paratypes 1.4-1.7 mm.), 2.2 times as long as wide; color black. Frons extensively excavated from epistomal horns to well back on the vertex, reaching inner margins of eyes and exceeding width of eyes above, upper margin acute; surface of excavation smooth, shining, a feeble median elevation on lower half; horns rather large, as long as longitudinal axis of excavation, their proximal half fused, diverging slightly apically, the subapical tufts of hair well developed; a pair of small tubercles located on lateral margins just above antennal insertion; vestiture confined to horns and epistomal margin. Antennal club large, circular in outline, the sutures very strongly bisinuate.

Pronotum 1.02 times as long as wide; outline as in *niger;* asperities attain anterior margin and blend laterally with rounded granules; a few, fine, punctures evident laterally; vestiture hairlike, longer anteriorly.

Elytra 1.3 times as long as wide, 1.3 times as long as pronotum; outline as in *niger;* striae 1 weakly, others not at all impressed, the punctures coarse, deep, close; interstriae almost as wide as striae, shining, undulating slightly, the punctures uniseriate, rather coarse, deep, close, not at all granulate. Declivity steep, broadly, rather shallowly sulcate; general sculpture as in *niger,* the tubercles on interstriae 3-9 uniseriate, comparatively small, those on lower half of 1 and 2 obsolete. Vestiture consisting of uniseriate rows of interstrial hair; not evident in impressed area of declivity.

Female.—Similar to male except frons weakly convex, flattened below, with a pair of low, subtuberculate, raised areas in position of male horns.



Figs. 9-10. *Cactopinus nasutus,* male: 9, left, anterolateral aspect of head; 10, right, lateral aspect of elytral declivity.

Type Locality.—Sixteen km. (10 mi.) south of Matamoros, Puebla, Mexico.

Type Material.—The male holotype, female allotype and 67 paratypes were collected at the type locality on June 14, 1967, 1,700 m., No. 36, by S. L. Wood, from a broken giant cactus; 12 paratypes were taken 6 km. (4 mi.) north of Totolapan, Oaxaca, Mexico, June 20, 1967, 1,200 m., No. 67, by S. L. Wood, from a broken giant cactus in series with *granulifer.*

The holotype, allotype and paratypes are in my collection.

Cactopinus carinatus n. sp.

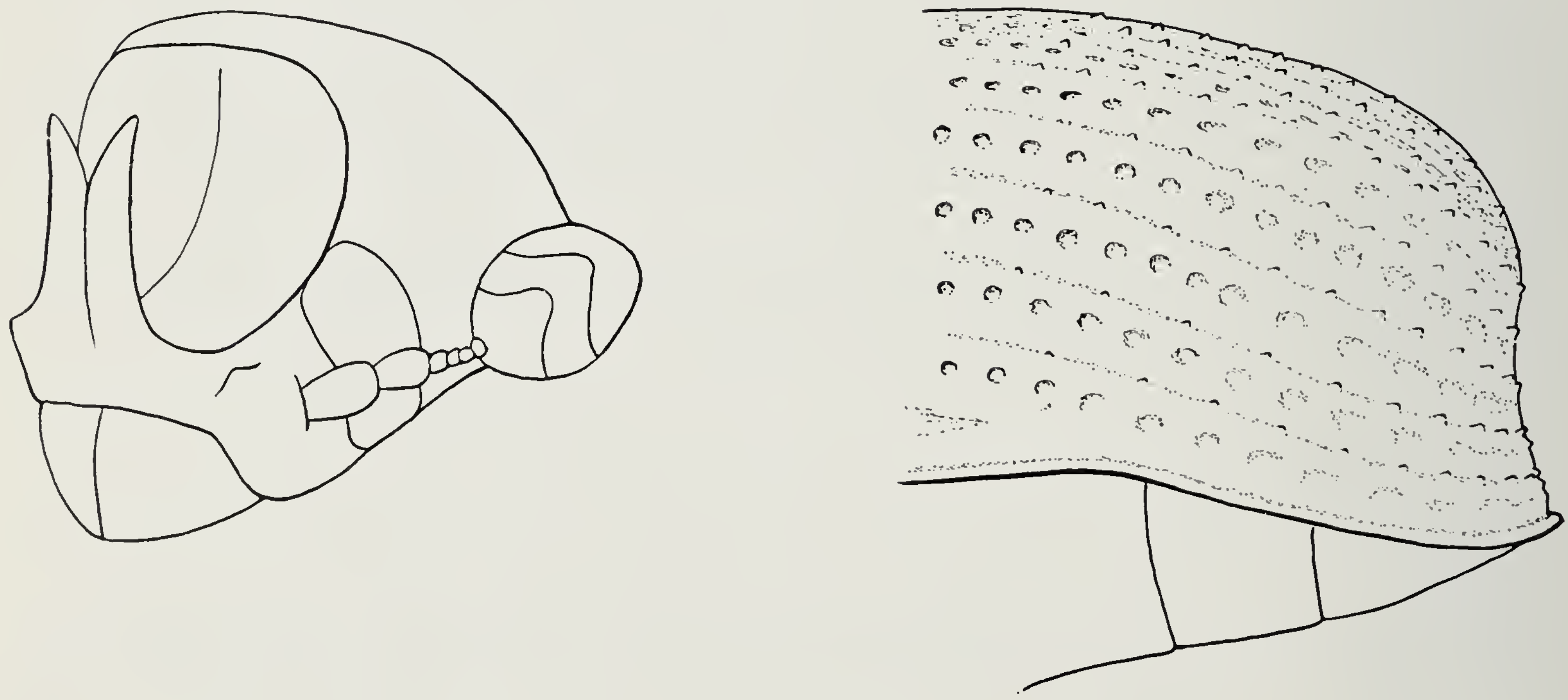
This species is very closely related to *nasutus* Wood, described above, but it is distinguished by characters summarized in the above key.

Male.—Length 1.6 mm. (paratypes 1.5-1.8 mm.), 2.4 times as long as wide; color black.

Frons as in *nasutus* except excavation slightly less extensive above, and divided by a distinctly elevated, median carina; the horns slightly smaller. Antennal club large, subcircular in outline, the sutures very strongly bisinuate, 1 angulate.

Pronotum and elytra as in *nasutus* except strial punctures smaller, interstrial punctures on disc minute, the declivital granules of reduced size, and declivital sulcus narrower, the lateral convexities more abruptly elevated.

Female.—Similar to female of *nasutus* except frons with a median carina on upper half, the transverse impression at upper level of eyes more pronounced, and the subepistomal elevations somewhat more extensive.



Figs. 11-12. *Cactopinus carinatus,* male: 11, left, anterolateral aspect of head; 12, right, lateral aspect of elytral declivity.

Type Locality.—Twenty-six km. (16 mi.) north of Ixmiquilpan, Hidalgo, Mexico.

Type Material.—The male holotype, female allotype and 46 paratypes were collected at the type locality on July 10, 1967, 1,700 m., No. 190, by S. L. Wood, from a broken giant cactus.

The holotype, allotype and paratypes are in my collection.

Cactopinus depressus Bright

This species was described (Bright, 1967) from two encrusted males taken from *Yucca* in the State of San Luis Potosi, Mexico. A series of 121 specimens were taken from *Yucca* leaves 26 km. north of Ixmiquilpan, Hidalgo, Mexico, on July 10, 1967, 1,900 m. elevation, by myself. The monogamous adult beetles excavated a transversely elongate, cave-type gallery where eggs were deposited along the margins, in individual niches. The larval mines extended parallel to the longitudinal leaf fibers in the direction away from the parental gallery. The yellow, recently dead leaves immediately below the green growing portion of the living plant, were selected for attack. There appeared to be more attacks on the basal half of the leaf; this might have been to avoid high temperatures from direct sunlight.

The female of the species has not been reported previously.

Female.—Length 1.3 mm., 2.6 times as long as wide; color very dark brown, the summit usually lighter.

Frons convex above, weakly impressed on median third below; surface subreticulate with obscure punctures; a conspicuous permandibular epistomal lobe present; vestiture of coarse, moderately abundant, rather long hair, epistomal brush conspicuous. Antennal club small, broadly oval, the sutures evidently straight, not clearly indicated.

Pronotum 0.95 times as long as wide; widest at middle, the sides moderately arcuate, not noticeably converging before the very broadly rounded anterior margin; posteromedian area not produced toward scutellum; asperities confined to a triangular area, the asperate area subinflated posteriorly, the asperities extending from anterior margin to posteromedian area but ending before posterior margin; lateral areas minutely granulose, devoid of granules and punctures; vestiture hairlike, some setae coarse.

Elytra 1.54 times as long as wide, 1.63 times as long as pronotum; sides almost straight and parallel on basal three-fourths, rather broadly rounded behind; striae not impressed, the punctures very small, shallow; interstriae as wide or wider than striae, the punctures not indicated; surfaces usually covered by an incrustation even in teneral specimens. Declivity rather steep but much more gradual than in other *Cactopinus,* the sulcus very shallow, narow; devoid of granules. Vestiture consisting of sparse interstrial hair.

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Notes on *Matheteus theveneti* LeConte[1]
(Coleoptera: Lampyridae)

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Matheteus theveneti LeConte is, as far as I have been able to ascertain, the only North American species of Lampyridae in which the dorsal surface is largely roseate. The reason for this reversal of character especially in the Pacific Northwest where the species are in large part black, has been difficult to understand. About the only collections of any size have been made by Mrs. Dorothy McKey-Fender and Mr. L. C. Peterson who have managed to get me quite a series. These were collected near the Seven Devils Road, a couple of miles south of Charleston, on the Oregon Coast.

Mrs. McKey-Fender had noticed that the flight time for the species is quite brief, usually confined to from about ten days to two weeks.

On April 26, 1969, I was privileged to observe this species in that area, which is along a narrow north-south ridge. On each side of this ridge is a deep, heavily thicketed ravine. The most abundant trees of these ravines are: *Alnus rubra* Bong., *Picea sitchensis* (Bong.) Carr., *Chamaecyparis Lawsoniana* Parl. and *Myrica californica* Cham. Shrubs of the area are: *Rubus spectabilis* Pursh., *Vaccinium ovatum* Pursh. and *Gaultheria Shallon* Pursh. About the only plants of importance constituting a so-called herb layer are: *Polystichum munitum* (Kaulf.) Presl. and *Struthiopteris spicant* (L.) Weis.

In these thicketed areas these roseate beetles show up fairly well and would be readily distinguishable except that they are emergent at the time that the roseate petals of the Salmon Berry *(Rubus spectabilis)* are being dropped. The beetles resemble those fallen leaves in size, shape, and color. The similarity is quite noticeable in the shaded areas of the thickets. Quite a number of fallen petals were examined in the anticipation that there might be yet another beetle.

The advantage of an apparent protective device such as this is obvious. In almost any other situation or time the beetles would be much more conspicuous and ready game for predators.

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[1] This study was supported by National Science Foundation Grant GB-6283X

NOTICE

SHARP & MUIR: THE COMPARATIVE ANATOMY OF THE MALE GENITAL TUBE IN COLEOPTERA. The classic 1912 monograph and six other papers by the same authors have been reprinted. 304 pp., 43 pls., bound. $10.00. An essential book for all coleopterists. Entomological Society of America, 4603 Calvert Road, College Park, Maryland, 20740.

Species of *Coenonycha* Horn from Mainland Baja California, Mexico (Coleoptera: Scarabaeidae)[1]

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The genus *Coenonycha* Horn was revised by Cazier and McClay (1943), with one species being subsequently described (Potts, 1945). Of the 29 described species, only *Coenonycha socialis* Horn, endemic to Guadalupe Island, Mexico, has been reported from south of the United States.[2] The present paper deals with two species that have been recently collected on mainland Baja California, Mexico. Both species have fully developed metathoracic wings and are seemingly rather closely related.

Coenonycha rotundata (LeConte)

MALES—Length 7.2 to 8.0 mm., greatest width 3.4 to 3.7 mm. Dorsal color dark reddish brown. Clypeus shallowly reflexed, less so laterally; anterior margin straight or very slightly emarginate; angles abruptly obtuse, not elevated; lateral margins evenly arcuate, only slightly elevated basally. Disc of clypeus rugose-punctate, more so medially. Clypeal suture distinct, shallowly indented, sinuate. Frons heavily, coarsely punctate, the punctures irregularly confluent near clypeal suture, distinct posteriorly. Vertex heavily, coarsely punctate except for small impunctate area medially near pronotal margin. Pronotum widest at middle, lateral margins evenly arcuate from middle to base, anteriorly shallowly sinuate near anterior angles; each anterior angle acute, somewhat produced, with a group of ocular setae extending forward approximately half the length of the eye. Pronotal marginal line (bead) complete, the line behind the anterior margin nearly straight, distinctly impressed. Pronotal disc moderately convex and coarsely punctate, the punctures separated by one to two diameters, most punctures each with a pale seta. Elytra with sides almost parallel, humeral umbones well developed; each elytron with two to four costae faintly indicated, sometimes obsolete; surface heavily punctate-setose, the punctures usually separated by less than one diameter. Number of elytral punctures between first and second costae (in a roughly transverse line) average between five and six. Metathoracic wings fully developed, apices rounded. Pygidium finely punctate-setose, the setae long and semi-erect; pygidial surface alutaceous. Antenna ten segmented, club approximately as long as adjacent six segments. Ventral surfaces as described by Cazier and McClay (1943, p. 17). Genitalia as in Fig. 1.

FEMALES.—Length 8.0 to 9.2 mm., greatest width 3.5 to 4.1 mm. Similar to males except in the following respects: clypeal disc and frons with punctures more discrete, lacking rugose appearance; clypeus on the average slightly wider; eyes smaller; setae on elytra approximately half as long as those of males, inconspicuous; antennal club shorter than adjacent six segments.

SPECIMENS EXAMINED—9 males, 6 females. 1 female, type (MCZ), southern California; 1 female, Arroyo Santo Domingo, 5.7 miles N. of Hamilton Ranch, Baja California, Mexico, 22 April 1963, P. H. Arnaud and H.B. Leech; 1 male, Coronado, California, H.C. Fall; 2 females, Hamilton Ranch, Baja California, Mexico, 21 April 1963, P.H. Arnaud and H.B. Leech; 1 female, 12 miles S.E. Maneandero, Baja California, Norte, Mexico, 19 April 1965, D.Q. Cavagnaro,

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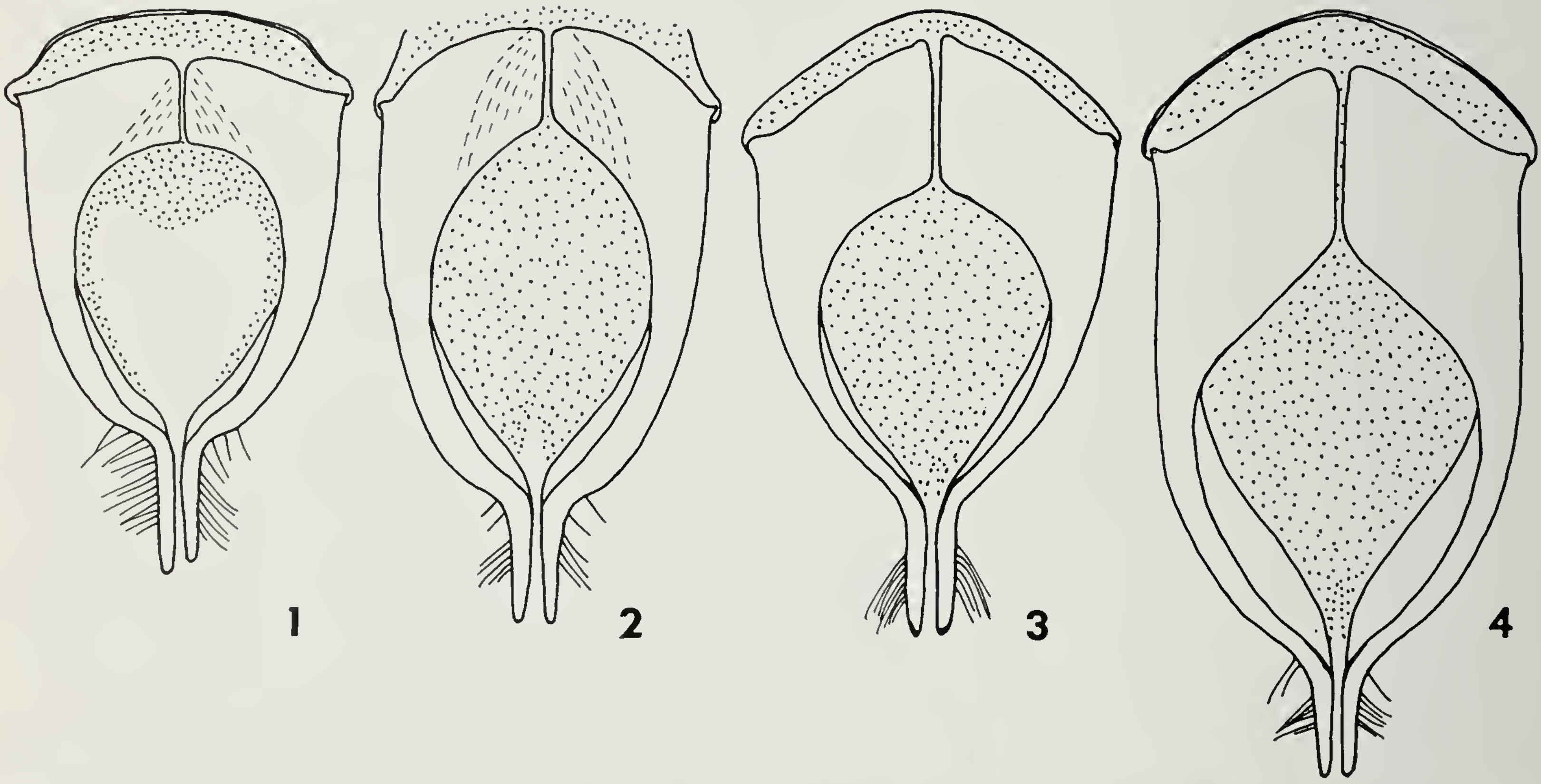
[1] This study was supported in part by a grant from the National Research Council of Canada (No. A5078).

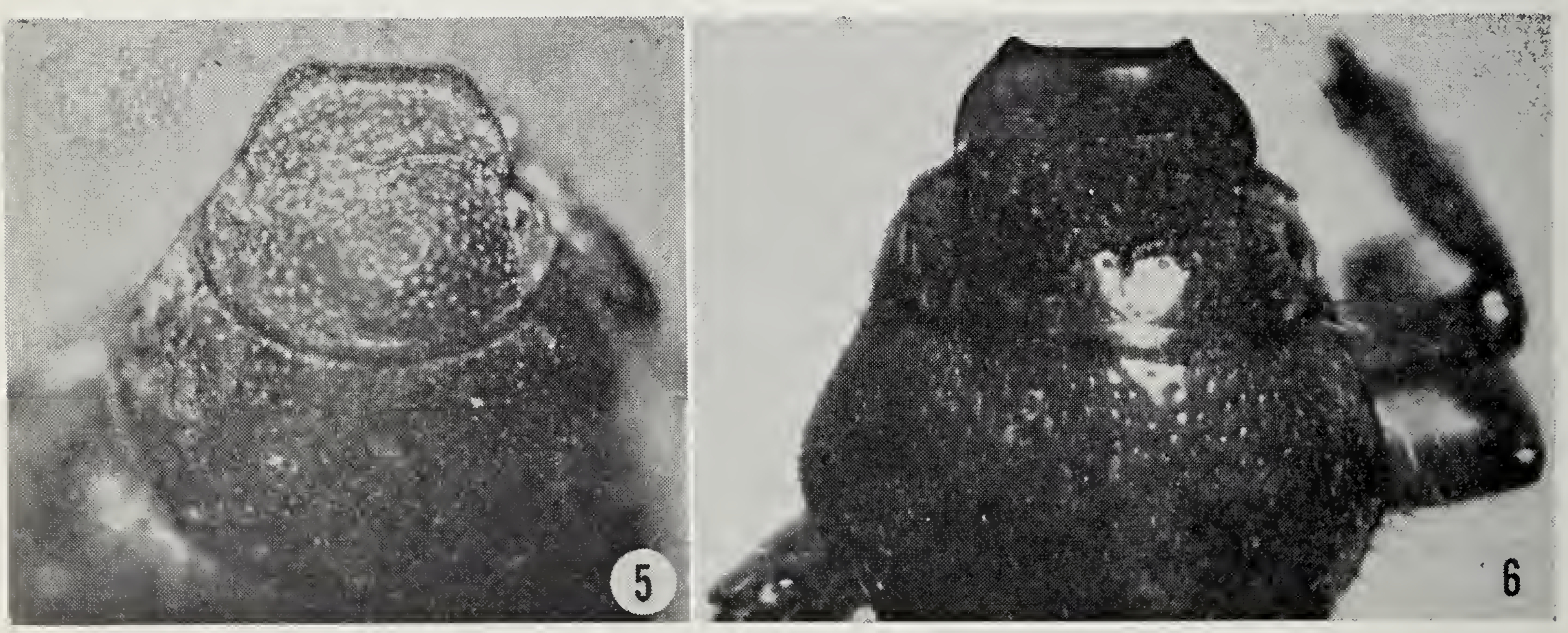
[2] Subsequent to the submission of this manuscript two specimens of *Coenonycha testacea* Cazier have been examined bearing the following data: 13 miles S. W. La Zapopita, Baja California Norte, 14 June 1963, E. L. Sleeper.

C.E. and E.S. Ross, and V.L. Vesterby; 8 males, 1 female, 3 miles N.W. Villa Juarez, Baja California, Mexico, 28 April 1963, P.H. Arnaud and H. B. Leech.

VARIATION—In the small series examined it is slight. In two specimens the clypeal angles are rounded, not abrupt. The degree of sinuation of the lateral pronotal margins near the anterior angles varies, but is usually obvious. There is a difference in dorsal vestiture, but this is probably due to abrasion. In other respects, including size and color, the species seems fairly uniform.

The species has been redescribed here, since Cazier and McClay (1943) seemingly based their description on a single pair. I have re-examined the male of this pair (it is in rather poor condition), and included it in the above description. The female type of LeConte is in very poor condition, seemingly being taken from a spider web. Most tarsi are missing, the abdomen is damaged and the head (Fig. 5) is dirty and somewhat worn.





Figures 1-4.—Parameres of male genitalia of *Coenonycha:* 1, *rotundata* (LeConte); 2, *rufobrunnae* n. sp.; 3, *fusca* McClay; 4, *testacea* Cazier.

Figures 5-6.—Dorsal view of heads of *Coenonycha:* 5, *rotundata* (LeConte), female type; 6, *rufobrunnae,* male.

In using the key to the species of *Coenonycha* (Cazier and McClay, 1943, p. 10), considerable difficulty was encountered with *rotundata* (even using the male described in the paper). In couplet 12 some specimens would fall in either dichotomy. The clypeal angles of *rotundata* are not elevated above the rest of the margin; therefore, the margin on either side is essentially of equal height. In most specimens the anterior margin is slightly more reflexed than the lateral margins. The latter character would key to couplet 16 (the correct one), but here too there are difficulties. In the description of the species Cazier and McClay (1943, p. 17) give the color as "dark reddish brown throughout." In couplet 16, *rotundata* has to be keyed through the first part of the couplet which reads "dorsal surface entirely or in greater part testaceous (generally pale testaceous)—17." The other part of the couplet includes "reddish brown" species but this takes one beyond *rotundata* in the key.

The species *rotundata* may be distinguished from other *Coenonycha* by the following combination of characters: metathoracic wings fully developed, color dark reddish brown, size 7.2 to 9.2 mm. (males and females), angles of clypeus not elevated above margin, margin rather evenly reflexed, lateral pronotal margins near anterior angles usually sinuate, pronotal punctures large and separated by one or more diameters, elytra distinctly setose.

Cazier and McClay related *rotundata* to *clypeata* McClay, *fulva* McClay and *testacea* Cazier. Of these, *clypeata* seems most closely related; it can be separated from *rotundata* by its more setose head and pronotum, generally larger size, and by its range. The dark color will separate *rotundata* from either *fulva* or *testacea*. Also I consider *fusca* McClay quite closely related to *rotundata* but it, as well as *testacea,* show genitalic differences (Figs. 3. 4.). Seemingly the closest relative to *rotundata* is described below.

***Coenonycha rufobrunnae* Howden, NEW SPECIES**

HOLOTYPE.—Male, length 8.8 mm., greatest width 3.7 mm. Dorsal color reddish brown. Clypeus shallowly reflexed anteriorly and laterally except for elevated, abrupt angles; anterior margin shallowly emarginate between angles; lateral margins gradually arcuate, more distinctly elevated basally than in *rotundata*. Disc of clypeus coarsely punctate, the punctures contiguous medially and somewhat irregular, surface not distinctly rugose. Clypeal suture distinct, moderately indented, sinuate. Frons coarsely, contiguously punctate, some punctures confluent anteriorly. Vertex with anterior third coarsely punctate, a median transverse area impunctate, and posterior third with numerous, moderately fine punctures. Pronotum widest at middle, lateral margins evenly arcute from middle to base, anteriorly very shallowly sinuate near anterior angles; each anterior angle acute, slightly produced, with a group of ocular setae extending forward approximately one-third the length of the eye. Pronotal marginal line (bead) complete, the impressed line behind the anterior margin slightly arcuate anteriorly near median line. Pronotal disc moderately convex and coarsely punctate, the punctures separated by less than one-half diameter in posterior half of pronotum, by approximately one diameter in anterior half; some lateral and posterior punctures each with a pale seta. Elytra with sides almost parallel, humeral umbones well developed; each elytron with four costae (excluding sutural one) indicated; surface heavily punctate-setose, the setae shorter than in *rotundata* and inconspicuous. Number of elytral punctures between first and second costae (in a roughly transverse line) average between four and five. Metathoracic wings fully developed, apices rounded. Pygidium finely punctate-setose, the setae moderately long and semi-erect; pygidial surface alutaceous. Antenna ten segmented, club slightly shorter than adjacent six segments. Ventral surface as in *rotundata*. Genitalia as in Fig. 2.

ALLOTYPE.—Female, length 9.1 mm., greatest width 4.0 mm. Similar to holotype except in the following respects: clypeal angles less produced, clypeus slightly wider; eyes smaller; setae on elytra slightly shorter and less conspicuous; antennae club approximately as long as adjacent five segments.

Type material—Holotype, male, 7 miles N.N.W. (Rancho) Rosarito, Baja California, Mexico, 8-9 April 1961, Allyn G. Smith (CAS). Allotype, female, same data as holotype (CAS).

Paratypes—22 males, 24 females. 1 male, 8 females, same data as holotype; 2 males, 31 miles N. El Arco, Baja California, Mexico, 10 December 1958, H.B. Leech, at light; 1 male, El Arenoso, Baja California, Mexico, 20 January 1960, D. Porter; 1 male, 3 females, 2 miles N.E. El Rosario, Baja California, Mexico, 7 December 1958, H.B. Leech, at light; 1 male, 22 miles N. Punta Prieta, Baja California, Mexico, 9 December 1958, H.B. Leech, at light; 1 male, 4 miles W. San Vicente, Baja California, Mexico, 2 November 1958, R. K. Selander; 5 females, 9 miles E. Rosario, Baja California Norte, 29 March 1961, E. L. Sleeper; 15 males, 8 females, 7.5 miles S. Santo Thomas, Baja California, 29 January 1968, E. L. Sleeper.

Paratypes are deposited in the following collections: CAS, CNC (No. 10456), Howden, Sleeper.

Variation—It is most evident in specimens from different localities. Size ranges from 7.8 to 9.3 mm. in length and from 3.3 to 4.2 mm. in greatest width, with females usually slightly larger than males. Females usually have the somewhat dentiform clypeal angles less pronounced and appear more robust than males. The central emargination of the clypeus is more pronounced and the color more nearly brown in the specimens from El Arenoso and San Vicente. Length of dorsal setae and the density of the pronotal punctures also show moderate variation.

Coenonycha rufobrunnea is most closely related to *rotundata;* it can be separated from *rotundata* by its elevated (almost dentiform) anterior clypeal angles; by its lighter, reddish brown color; and by its less conspicuous dorsal setae. Two other species, *rubida* McClay and *fusca* McClay are rather closely related; *rubida* may be distinguished from *rufobrunnea* by its densely punctate pronotum and *fusca* has clypeal and genitalic (Fig. 3) differences.

In Cazier and McClay (1943) *rufobrunnea* will usually key to *purshiae* Cazier. It can be separated from this species by its larger, more widely separated pronotal punctures and less bidentate clypeus.

ACKNOWLEDGMENTS

I am indebted to Mr. Hugh B. Leech, California Academy of Sciences, and Dr. R. B. Selander, University of Illinois, for furnishing the specimens included in this study.

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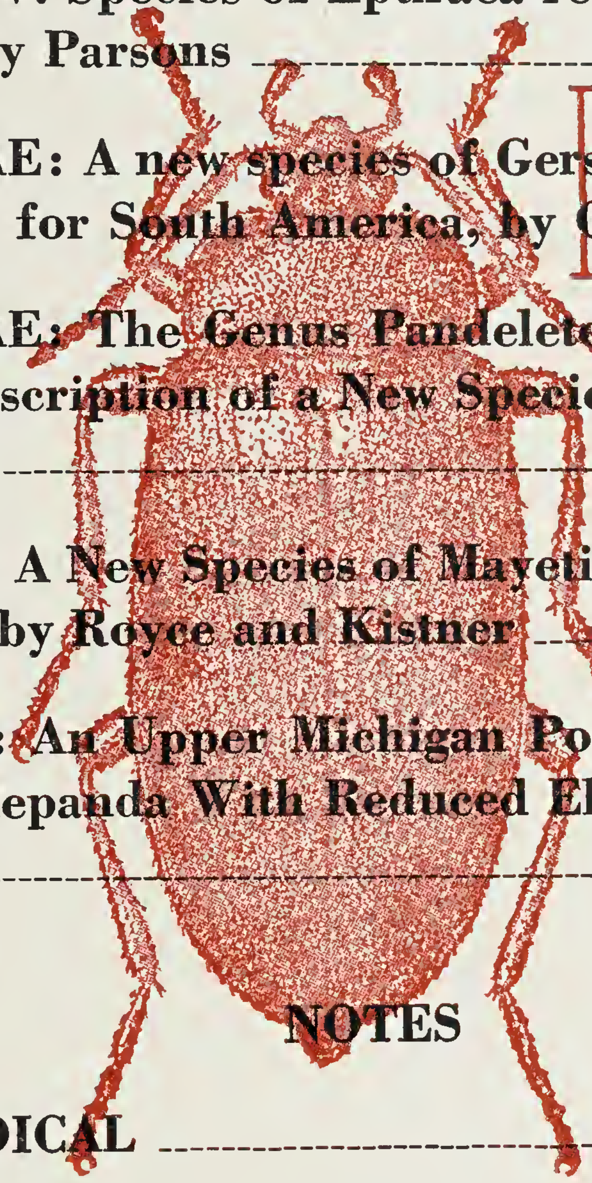

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Larva and pupa of *Pyanisia tristis* from Alabama (Coleoptera: Tenebrionidae)

T. J. SPILMAN[1]

SYST. ENT. LAB., ENTOMOLOGY RESEARCH DIVISION, AGRICULTURAL RESEARCH SERVICE, USDA[2]

The genus *Pyanisia* Laporte, the only New World member of the Amarygmini, contains nine species. All are found in Latin America, but two species, *tristis* (Laporte) and *opaca* (Solier), also extend into the Gulf Coast area of the southeastern United States. Nothing has been published on the immature stages of *Pyanisia* and only very little on their habits; Champion (1887:329) said the species of *Pyanisia* are found beneath loose bark or about fungoid growths on decaying trees, often in gloomy places in the forests, and Wickham (1898:83) found *tristis* under logs in the woods.

The immature stages of one species, *Pyanisia tristis,* can now be described. The specimens, 3 adults, 1 pupa, and 4 larvae, were collected at Brookley Field Air Base, Mobile, Alabama, June 23, 1967, by R. C. Goff and W. T. Seibels, in decayed lumber. The boards, mostly pine, were wrapped in bundles of six and metal tapes were around each bundle; most of the wood was infested with termites, fungus gnats, and *Pyanisia tristis.* The beetle larvae were tunneling across the grain in the heart of the lumber, and their galleries were filled with sawdust. Neither the origin of the lumber nor the time or place of infestation of the beetles could be determined.

LARVA

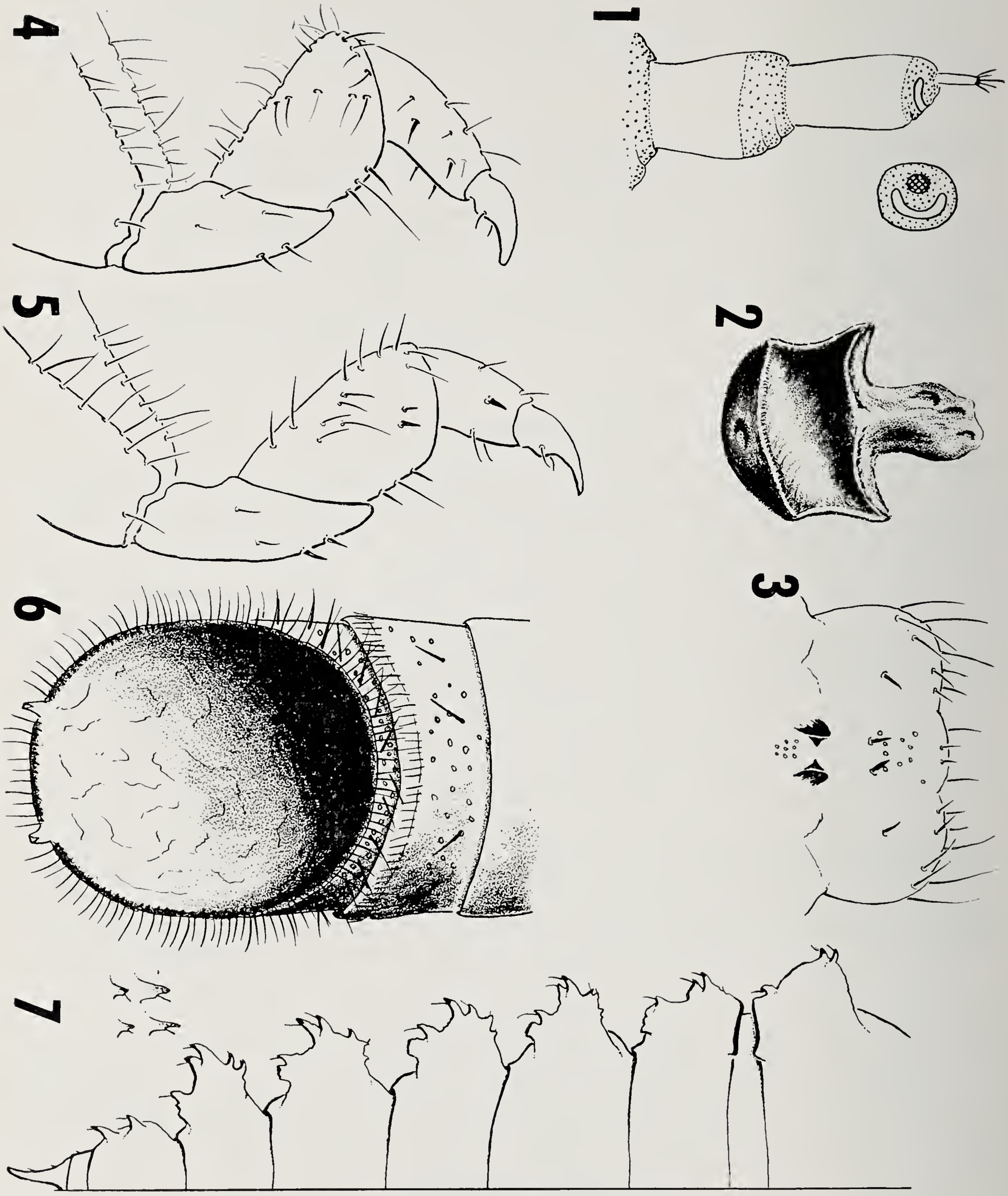
Body elongate, cylindrical, wireworm-like; length, 3 specimens approximately 28 mm., 1 specimen very short because of abnormalities; surface shiny, moderately sclerotized and white except mandibles black and last two abdominal segments light yellow-brown; with a few long, slender setae on most body areas.

Head. Subglobular, surface smooth, without obvious punctures, setae few on frons, numerous epistoma and lateral and posterior areas of capsule, most setae short; head capsule 2.7-3.3 mm. wide. Clypeus smooth, impunctate, with 4 long setae; clypeal condylus strongly produced. Labrum smooth, with minute punctures, length subequal to length of clypeus; with transverse row of 6 widely spaced slender setae. Labrum with buccal surface (fig. 3) not having sensilla lateral to medial anterior setae; anterior sensillae in two rows; with 4 subanterior sensillae; with pair of unisetiferous sensillae, their setae coarse; without longitudial row of setae lateral to unisetiferous sensillae; with triangular tormae;

---

[1] I acknowledge with thanks the help given me by W. T. Seibels and Virgil M. Owens, of the U. S. Department of Agriculture, and Lee H. Herman, Jr., of the American Museum of Natural History.

[2] Mail address: c/o U. S. National Museum, Washington, D. C. 20560



Figures 1-7.—*Pyanisia tristis,* 1-6 larva, 7 pupa. 1—Antenna and dorsal view of membranous part of second segment showing sensorium. 2—Hypopharyngeal sclerome of labium. 3—Labrum, buccal surface. 4—Prothoracic leg, posterior view. 5—Metathoracic leg, posterior view. 6—Apex of abdomen, dorsal view. 7—Abdomen of pupa, dorsal view, with a few small setiferous acute spines (inset).

with 8 posterior sensillae. Mandibles with apex tridentate; molar area of right mandible with 2 weak, irregular carinae. Maxilla with mala broad, parallel-sided, and truncate; palpus with segments short and stout. Labium with ligula pronounced, arcuate, buccal surface with 2 coarse setae and 2 papillae; then more posteriorly and laterally with pair of long coarse setae; hypopharyngeal sclerome (fig. 2) heavily sclerotized, projecting, with lateral borders incurved, posterior border carinate and excurved, surface very strongly concave, anterior border bisinuate and with narrow finger-like process. Antenna (fig. 1) with segment 2 relatively short; apex of 2 with narrow C-shaped white area, the sensorium.

Body. Terga with small, mostly transverse wrinkles. (In the following, 1st, 2nd, etc., refer to abdominal segments.) Thoracic and 1st through 7th without punctures. Prothoracic with anterior border having approximately 20 long and short slender setae, with posterior border having 6 to 8 long and short slender setae. Mesothoracic, metathoracic, and 1st through 7th with 6 to 8 short and long slender setae on both anterior and posterior border. Mesothoracic, metathoracic, and 1st through 8th with very vague longitudinal line on one specimen but with line invisible on others. Spiracles of 1st large, longer than wide, those of 2nd through 8th smaller, about 0.7 size of 1st, becoming progressively more circular on posterior segments. 8th segment one-half length of 7th; with numerous small cribriform punctures on dorsal area of tergum; setae on anterior border as on previous segments but on posterior border much more numerous. Ninth segment (fig. 6) dorsally with deep concavity which is slightly longer than broad, border of concavity with very dense, very short setae causing a fuzzy appearance, with fewer long slender setae, and posteriorly with 2 sharp recurved hooks; surface of concavity smooth, with minute setae of moderate density; surface anterior to concavity with dense cribriform punctures, many with an erect slender seta; punctures on lateral and ventral surfaces less dense than those on dorsal surface, becoming sparser as distance from border of concavity increases. Anal papillae small, projecting, short.

Legs (figs. 4, 5). Sparsely setose, not modified for digging; prothoracic only slightly stouter than others. Coxae with long, slender setae on anterior and posterior dorsal borders. Protrochanter with 2 slender short setae on ventral surface. Profemure with 2 moderately long and 1 long slender setae on ventral surface and numerous slender setae on posterior and dorsal surfaces. Protibiotarus with 1 coarse and 2 slender setae on ventral surface, and 3 short coarse and 2 short slender setae on distal half of posterior surface, and 4 slender setae on dorsal surface. Meso- and metatrochanters with 2 short coarse setae on each ventral surface. Meso- and metafemora with 2 short coarse and 1 long slender setae on each ventral surface; and 2 short coarse and numerous long slender setae on posterior surface and numerous long slender setae on dorsal surface. Meso- and metatibiotarsus with 2 slender setae on ventral surface; 1 short coarse seta on posterior surface and 2 slender setae on dorsal surface.

PUPA

Body without obvious setae, though posterior segments with a few minute setae. Pronotum similar in shape to adult pronotum; posterior border bisinuate; lateral border with approximately 12 short acute spines of various sizes; anterior one-fourth of dorsal surface with approximately 10 such spines; all spines with slightly darker apex and subapical seta (fig. 7, inset). Abdomen (fig. 7) with terga broad, with lateral processes which project laterally on 1st and 2nd terga and dorsolaterally on 3rd through 7th (all processes are shown projecting laterally in my illustration). Paired gin traps formed by posterior border of 1st tergum and anterior border of 2nd tergum; anterior and posterior components of gin trap similar; short, broad, nearly truncate lobe with heavily sclerotized edge. 1st lateral process broadly projecting, with 2 small anterior and 1 small posterior tubercles. 2nd through 7th lateral processes broadly projecting, each with 2 large anterior and 1 large posterior tubercles and varying numbers of small or minute tubercles which are more numerous anteriorly, with broad irregular process posteriorly; borders of lateral processes thus variable and irregular. Lateral process of 7th tergum consisting only of 2 large acute tubercles. All tubercles of lateral processes with short subapical seta. 9th segment with pair of long, acute, diverging urogomphi, each with few, very short setae.

The previously recorded distribution of *Pyanisia tristis* is United States, Mexico, British Honduras, Guatemala, Nicaragua, Panama, Cuba, Isle of Pines, and Puerto Rico (Blackwelder 1945:543). I have found only three literature records of *tristis* in the United States, Brownsville, Texas (Wickham 1898:83; Linell 1899:183) and simply Texas (Leng 1920:237). In addition to the Alabama specimens described above I know of specimens from Brownsville, Texas, New Orleans, Louisiana, and Miami Beach and Biscayne Bay, Florida in the U. S. National Museum and American Museum of Natural History.[3]

Our other species, *opaca* (Solier), has been recorded from the United States and Mexico. It has been recorded from Texas (Horn 1876:252), from southern Florida and Texas (Schwarz 1878:462), from the United States (Henshaw 1885:-122; Linell 1899:183) and from Florida, Louisiana, and Texas (Leng 1920:237). However, I have not been able to locate any United States specimens of *opaca*, although a specimen of *tristis* from Biscayne Bay, Florida, in the American Museum of Natural History had been misidentified and labeled as *opaca*.

Curators might want to check their collections for United States specimens of these two species. The difference between the adults is obvious: the base of the pronotum is bisinuate in *tristis* and arcuate in *opaca*.

The immature stages of several members of the tenebrionid tribe Amarygmini have recently been described and illustrated: larva of *Plesiophthalmus nigrocyaneus* Motschulsky from Japan by Fukuda, Kurosa, and Hayashi (1959:-485, figs.), by Hayashi (1966:27, 34, figs.), and by Hayashi (1968:11, fig.), larva of *Plesiophthalmus spectabilis* Harold from Japan by Hayashi (1968:10, figs.); larva of *Elixota curva* Marseul from Japan by Hayashi (1966:28, 34, figs.); larva and pupa of *Amarygmus morio* (Fabricius) from Hawaii and many other Pacific

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[3] Recently specimens were found at Houston, Tex. in rotten oak timbers in a dry dock yard.

islands by Spilman (1966:297, figs.) All Amarygmini larvae have a strongly concave ninth abdominal segment, a very distinctive characteristic.

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A New Periodical

Volume 1, No. 1 of *Cicindela,* a quarterly devoted to the Cicindelidae, appeared in March 1969 under the senior editorship of Ronald H. Huber, 11921 Champlin Road, Osseo, Minn., 55369. The subscription rate is $3.50 a year and should be sent to Huber at the above address. The other two members of the editorial staff are R. C. Graves of Bowling Green University, Ohio and H. L. Willis of Wisconsin State University, Platteville.

The stated aim of the journal is to stimulate the exchange of ideas, literature, and specimens related to the Cicindelidae of the world hoping thus to advance the knowledge of the family. The editor notes that this journal is an experiment and to quote him "an inquiry into the merits (and shortcomings?) of extreme specialization—held in the optimistic perspective that sharing such a common interest will enhance cooperation and good fellowship between all members of the entomological community."

The first number contained a long article on the coastal tiger beetles of Texas, a short article on an unusual antennal formation, a long article on nomenclature, and several short research notices. The second issue contains notes on the tiger beetles of Chili, several articles on the collecting of tiger beetles, a continuation of the article on nomenclature from the first issue, and several short notes.

The journal is attractively put out with both the plates and text well done. The first two issues ran between 22 and 24 pages. The writer enjoyed both issues and found them to be informative. Time will tell whether there is a need or a place for such a journal as this.

N. M. D.

North American Nitidulidae (Coleoptera)

V. Species of *Epuraea* related to *corticina* Erichson

CARL T. PARSONS

MANCHESTER DEPOT, VERMONT

The present account concerns several North American nitidulid beetles belonging to the genus *Epuraea*. These beetles comprise a more or less related group which include our largest species, about 4 mm. long, except for the still larger *monogama* and *liebecki,* 5-6.3 mm. long. Also three of the species exhibit the most extreme development of the male mesotibiae. Although the evidence is clear only for *corticina,* possibly all of the *Epuraea* herein described feed as larvae and adults on spores of fungi which are parasitic on trees.

This group of *Epuraea* may be separated as follows.

1 Eleventh antennal segment about as large as ninth and tenth combined (Fig. 20); length 3.7-4.1 mm. .... **eximia** new species

1′ Eleventh antennal segment much smaller, of normal size (Figs. 8, 32, 44, 56) 2

2 Hind angles of prothorax prominent and acute, forming an angle of about 85° .... **corticina** Erichson

2′ Hind angles of prothorax less prominent, obtuse, forming an angle of about 110°-120° 3

3 Anterior emargination of prothorax shallow (Fig. 27), with depth of about .09mm.; submentum triangular (Fig. 31); male mesotibiae very feebly produced inward (Fig. 29) .... **lengi** new species

3′ Anterior emargination of prothorax deep, with depth of .125-.187 mm.; submentum indistinctly trapezoidal (Figs. 43, 55), male mesotibiae very strongly produced inward (Figs. 41, 53) 4

4. Eleventh antennal segment with reduced apex (Fig. 44); anterior prothoracic emargination (Fig. 39) about .187 mm. deep; male mesotibiae more strongly produced inward (Fig. 41) .... **alternata** new species

4′ Eleventh antennal segment with well developed apex (Fig. 56); anterior prothoracic emargination (Fig. 51) about .125 mm. deep; male mesotibiae less strongly produced inward (Fig. 53) .... **rufida** Melsheimer

Epuraea eximia new species

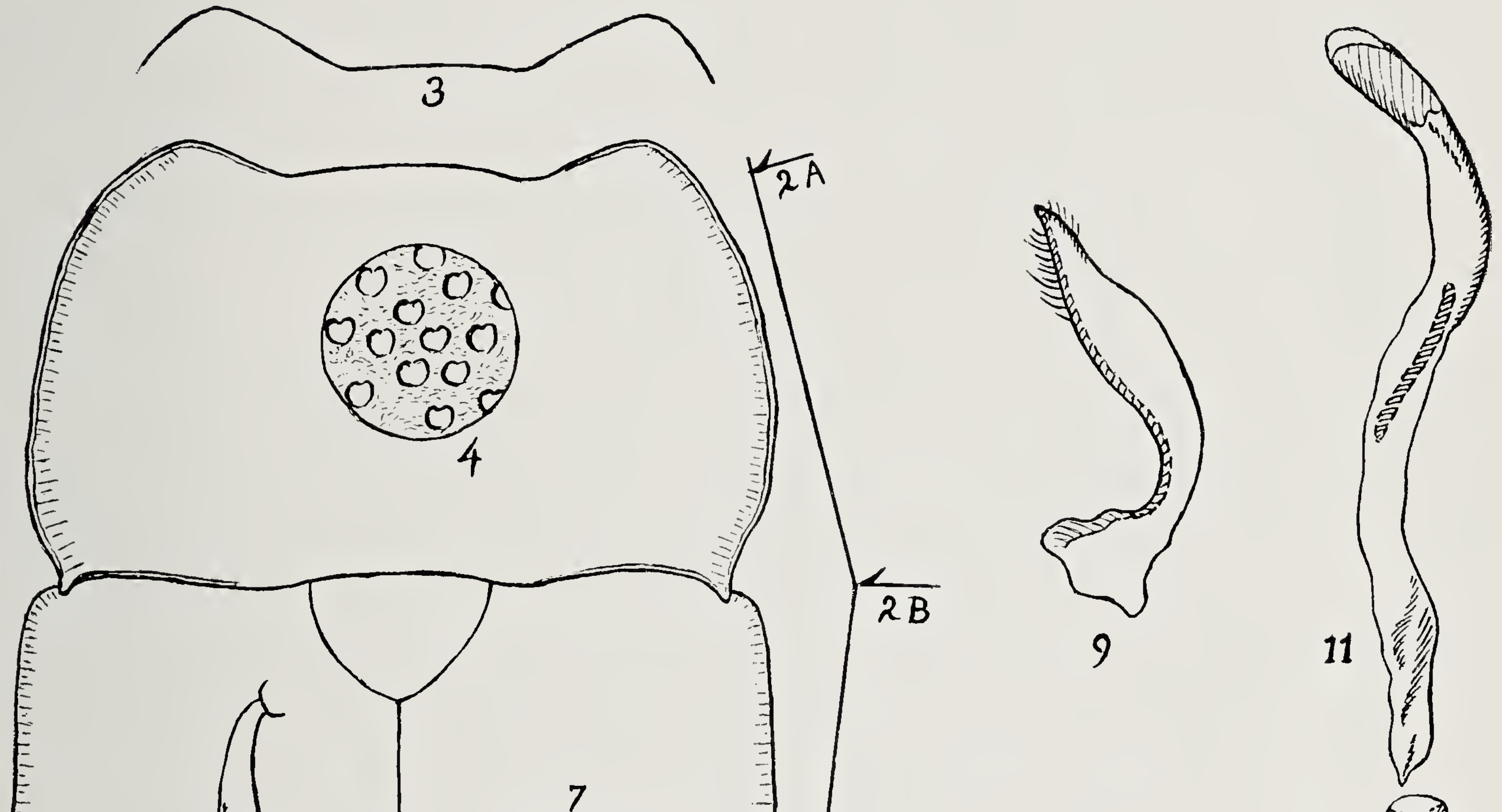
(Figs. 13-24)

A large (± 3.5 mm.) *Epuraea* with greatly enlarged eleventh antennal segment and feebly developed male mesotibiae. Color pale fuscous with legs, epipleurae, underside of head and prothorax more pale. A more or less pale area inside of each elytral humerus. Antennae becoming pale basally, club fuscous.

Vertex with rather shallow punctures separated by less than their diameters, punctures about same size as eye facets. Antennal club (Fig. 20) in both sexes with eleventh segment about as large as ninth and tenth segments combined. Submentum triangular, feebly convex, punctures separated on average by slightly less than their diameters. Antennal grooves (Fig. 19) moderately distinct. Anterior margin of prothorax emarginate as in Fig. 15. Prothorax with length to width as 1-1.71 (1.68 to 1-1.76) and width of prothorax to width of elytra as 1 to 1.04. Surface of pronotum vaguely uneven, much as in *lengi*. Lateral margins of prothorax feebly arcuate, narrowly explanate, very feebly reflexed, as in Fig. 13. Hind angles of prothorax forming an angle of about 100°. Disc of pronotum with punctures separated by about their diameters, intervals finely distinctly alutaceous, each puncture bearing a recumbent golden hair about .06 mm. long.

Elytra conjointly with width to length as 1-1.17 (1-1.15 to 1-1.19), elytral lateral margins more explanate and reflexed than pronotal margins; apices conjointly truncately rounded, sutural margins dehiscent at tip. Disc of elytra punctate about as on pronotum with the intervals more obsoletely alutaceous; each puncture bearing a recumbent golden hair about .06 mm. long.

Both sexes have the mesotibiae and metatibiae with three fine rows of spines and hairs along outer side but much less developed than in *alternata.* The male mesotibiae and metatibiae enlarged as in Figs. 17, 18. Total length 3.7-4.1 mm. Total length of holotype male 3.8 mm., of allotype 3.7 mm., of paratype male 4.1 mm. Length to posterior end of elytra: of holotype 3.4 mm., of allotype 3.2 mm., of paratype 3.7 mm.



Figs. 1-12. *Epuraea corticina,* male: 1, prothorax and elytra. 2, lateral view of axis of prothorax and elytra. 2A, line of sight for Fig. 3. 2B line of sight for Fig. 1. 3, anterior margin of pronotum. 4, punctaton of disc of pronotum with pubescence omitted. 5, dorsal view of mesotibia. 6, dorsal view of metatibia. 7, submentum and antennal grooves. 8, antennal club. 9, lateral view of tegmen. 10, dorsal view of tegmen. 11, lateral view of median lobe. 12, dorsal view of median lobe.

This species is distinctive in the greatly enlarged terminal antennal segment. The only other *Epuraea* with this characteristic is the Holarctic *depressa* (Illiger), but *depressa* is smaller (2.5-3.5 mm.), much more convex, and has simple male mesotibiae. *E. eximia* appears to be related to *lengi* in the uneven pronotal surface, very narrow pronotal margins, and feebly developed male mesotibiae. But the prothoracic hind angles of *eximia* are more acute and the prothoracic emargination much deeper. From *rufida* this species differs in the deeper prothoracic emargination and the much less developed male mesotibiae.

Type material: Holotype, male, Vowell's Mill, Louisiana, ex C. W. Leng in the author's collection. Allotype, female, and paratype, male, same data as holotype (CTP).[1]

Epuraea corticina **Erichson**

(Figs.1-12)

Epuraea corticina Er., 1843, in Germar, Zeitschr. für Ent., 4, 270.

A large (± 3.8 mm.) *Epuraea* with deep prothoracic emargination, prominent acute prothoracic hind angles and greatly expanded male mesotibiae. Color fuscous, with head, lateral thirds of pronotum, margins of elytra, legs, underside of prothorax, first and fifth abdominal sterna more or less testaceous. The center third of pronotum tending to piceous.

Vertex with punctures separated by less than their diameters, punctures about same size as eye facets. Antennae fuscous, becoming paler basally, club as in Fig. 8. Submentum (Fig. 7) triangular, feebly convex, punctures separated by a little more than their diameter. Anterior margin of prothorax deeply emarginate as in Fig. 3. Prothorax with length to width as 1-1.55 (1-1.51 to 1-1.62) and width of prothorax to width of elytra as 1 to 1.06. Lateral margins of prothorax rather strongly arcuate but very narrowly explanate and very feebly reflexed, as in Fig. 1. Hind angles of prothorax prominent and forming an angle of about 85°. Disc of pronotum with punctures separated on average by a little more than their diameters, intervals finely alutaceous, each puncture bearing a recumbent hair about .04 mm. long.

Elytra conjointly with width to length as 1-1.26 (1-1.22 to 1-1.31), elytral lateral margins distinctly more reflexed than pronotal margins, only the reflexed portion shown in Fig. 1; apices conjointly truncately rounded; sutural margins feebly dehiscent at tip. Disc of elytra slightly more finely and more sparsely punctate than pronotum, intervals finely alutaceous, each puncture bearing a recumbent golden hair about .06 mm. long.

Both sexes have the mesotibiae and metatibiae with three fine rows of spines and hairs along outer side but much less developed than in *alternata*. The male mesotibiae and metatibiae enlarged as in Figs. 5, 6. Length 3.0-3.9 mm., of plesiotype male 3.9 mm.

This species is readily recognized by prominent acute hind pronotal angles, the usually much darker center third of pronotum, less convex prothorax, the unusually deep prothoracic emargination, and the distinctive male mesotibiae.

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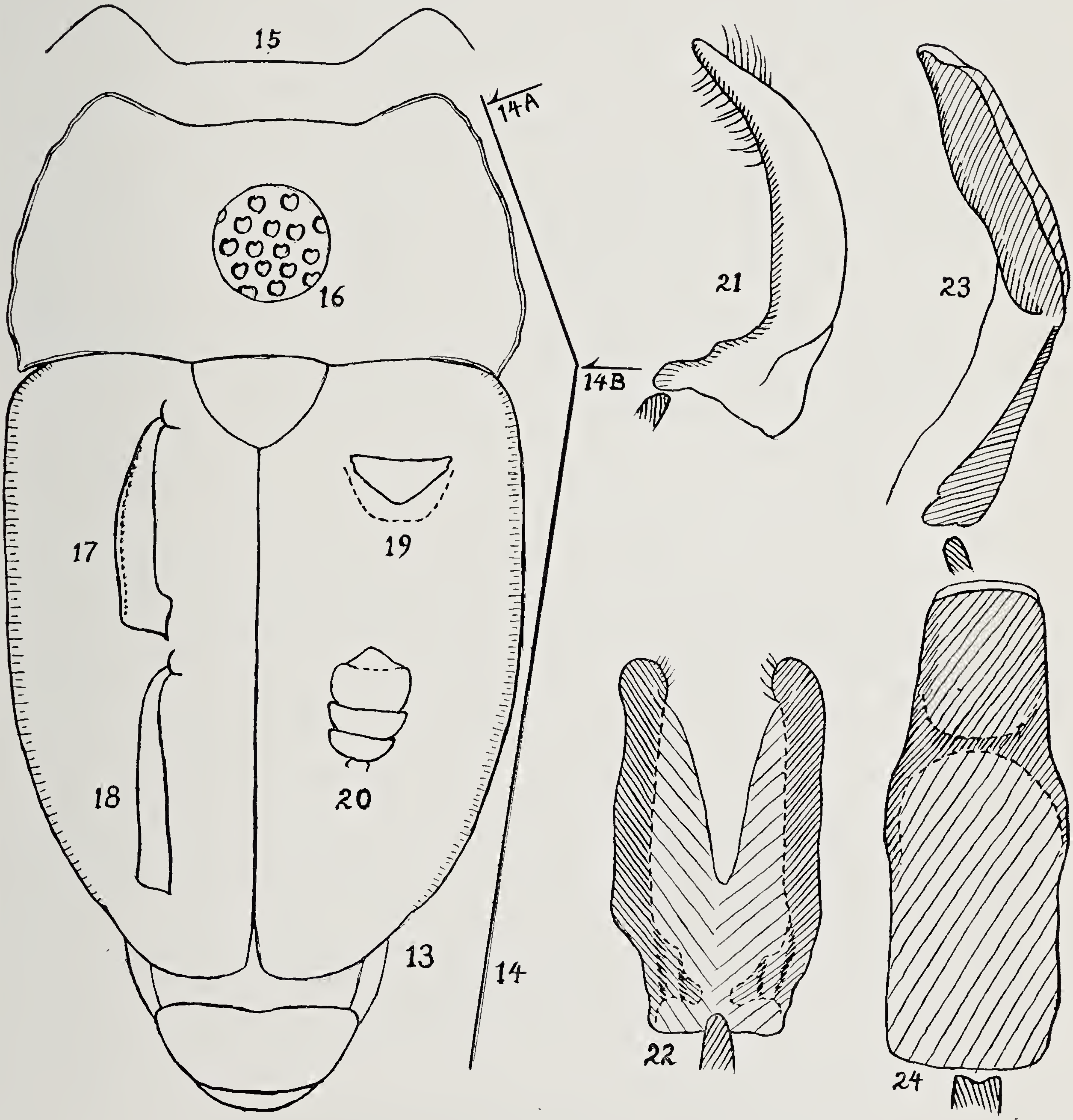
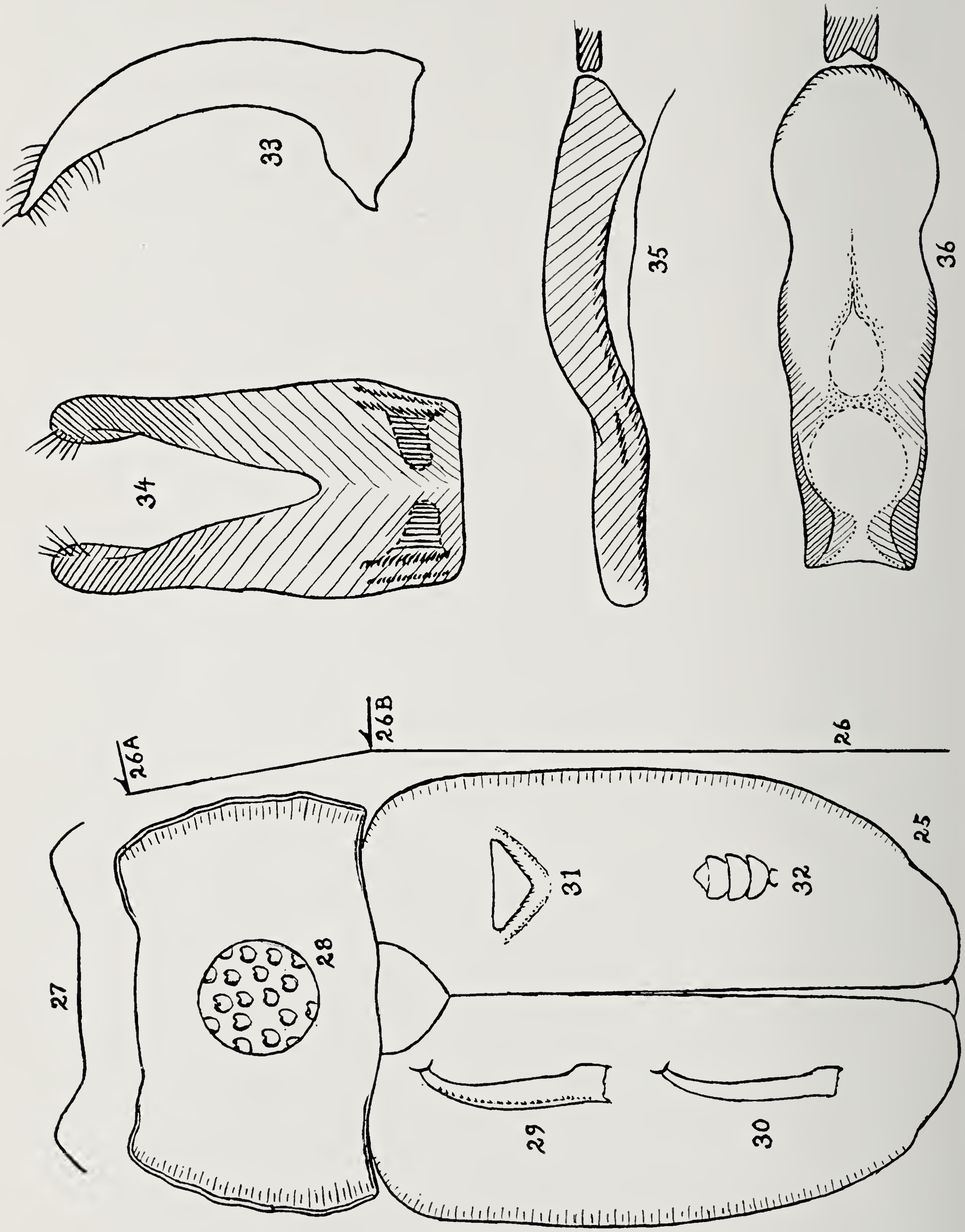
[1] Specimens in the collections of the following individuals and institutions were studied and are referred to by abbreviations as follows: (AMNH) American Museum of Natural History; (CAF) C. A. Frost in Museum of Comparative Zoology; (CAS) California Academy of Sciences; (CNC) Canadian National Collection; (CTP) C. T. Parsons; (CU) Cornell University; (GHN) G. H. Nelson; (HCF) H. C. Fall in Museum of Comparative Zoology; (HFH) H. F. Howden; (LRG) L. R. Gillogly; (MCZ) Museum of Comparative Zoology; (Un WIS) University of Wisconsin; (USNM) U. S. National Museum; (WAC) W. A. Connell at the University of Delaware.

Type material: Holotype, male, in the Knoch collection in the Berlin Museum not examined. The type locality is stated as North America but is presumably eastern Pennsylvania. Erickson's statement that the male mesotibiae are similar to those of the European *pusilla* agrees with *corticina* as here defined. Plesiotype male from Faison, N. C. (CTP).



Figs. 13-24. *Epuraea eximia,* male holotype: 13, prothorax and elytra. 14, lateral view of axis of prothorax and elytra. 14A, line of sight for Fig. 15. 14B, line of sight for Fig. 13. 15, anterior margin of pronotum. 16, punctation of disc of pronotum with pubescene omitted. 17, dorsal view of mesotibia. 18, ventral view of metatibia. 19, submentum and antennal grooves. 20, antennal club. 21, lateral view of tegmen. 22, dorsal view of tegmen. 23, lateral view of median lobe. 24, dorsal view of median lobe.



Figs. 25-36. *Epuraea lengi,* male holotype: 25, prothorax and elytra. 26, lateral view of axis of prothorax and elytra. 26A, line of sight for Fig. 27. 26B, line of sight for Fig. 25. 27, anterior margin of pronotum. 28, punctation of disc of pronotum with pubescence omitted. 29, dorsal view of mesotibia. 30, ventral view of metatibia. 31, submentum and antennal grooves. 32, antennal club. 33, lateral view of tegmen. 34, dorsal view of tegmen. 35, dorsal view of median lobe. 36, lateral view of median lobe.

This species occurs in Ontario, Quebec, Minnesota, Wisconsin, Indiana, New York, Massachusetts, Pennsylvania, Maryland, Delaware, Virginia, District of Columbia, North Carolina, South Carolina, Kentucky, Tennessee, Georgia, Florida, Alabama, Mississippi, Louisiana, Arkansas, Missouri, Kansas, and Iowa.

Ontario: Prince Edward Co., C. S. Brimley (CAS); Quebec: Old Chelsea, 15 May, S. D. Hicks (CNC); Minnesota: Minneapolis, 31 July 1917, F. C. Fletcher (CU); Wisconsin: Port Edwards and Nekosa, Wood Co., 20 June-23 October, chiefly during September, W. W. Barrett and L. H. McMullen (Un WIS) (CTP); Indiana: Marion Co., 7 June 1929 (CU); New York: Staten Island (CTP); Massachusetts: Natick, 30 July, C. A. Frost (GHN), Framingham 9 October, 26 May, C. A. Frost (GHN) Berlin, 7 July (LRG); Pennsylvania: West Grove, 27 April 1953, W. A. Connell (WAC), Dauphin Co., 19 August 1928, J. N. Knull (CAS); Maryland: College Park, 30 September, G. H. Nelson (GHN), Elk Neck State Park, 25 April 1959, W. A. Connell (WAC); Delaware: Newark, 1 April 1960, W. A. Connell (WAC), Cheswold, July 1954, W. A. Connell (WAC), Georgetown, 10 November, 1954, W. A. Connell (WAC); Virginia: Dismal Swamp, Deep Creek, 8 May, G. H. Nelson (GHN) (CTP); District of Columbia: April, May, July, Washington (USNM) (CTP); North Carolina: Chapel Hill, 21 October 1885 (CU), Raleigh, 9 March 1950 H. & A. Howden (HFH) (CTP) (CAF), Faison, 27 October 1950 H. Howen (HFH) (CTP), Lake Junaluska, 14 November 1952, J. S. Royce (USNM) (CTP); South Carolina: Charleston (MCZ); Kentucky: state label (CU); Tennessee: state label (MCZ); Georgia: Dunwoody (WAC), Athens, 17 May 1926 (AMNH); Florida: St. Augustine (MCZ); Alabama: Hazel, 10 April 1923 (AMNH), Mobile (USNM); Mississippi: Lucedale, 6 and 26 December 1929, H. Dietrich (CU) (HCF), North Augusta, 16 October, 16 December, 27 December, 6 March 1930 H. Dietrich (CU), Meridian (USNM); Louisiana: Vowell's Mill (CTP), Bayo Sara, 23 June, E. A. Schwarz (USNM); Arkansas: Hope (HCF), state label (CTP); Missouri: Salem, December 1952, W. D. Buchanan (USNM) (CTP); Kansas: Douglas Co.; Iowa: Burlington (MCZ).

Ethology. This species may be involved in the transmission of oak wilt, *Chalara quercina*, since it has been collected, chiefly during the fall, on oak wilt fungus mats in Wisconsin, North Carolina, and Missouri. In Wisconsin McMullen collected a larva on a fungus mat on September 11. The adult emerged on November 6. Adults have also been taken in Pennsylvania at sap flow of white oak stump in April, in North Carolina at sap flow of *Liquidambar styraciflua* in October. It has been collected in Alabama at *Crataegus* blossoms during April and in Virginia at tulip tree blossoms in May.

Epuraea lengi new species

(Figs. 25-36)

A rather large (± 3 mm.) *Epuraea*, usually testaceous rarely fuscous, with feebly developed male mesotibiae and prothorax feebly emarginate anteriorly.

Vertex with rather deep punctures separated by less than their diameters, punctures about same size as eye facets. Antennae testaceous with the eleventh, sometimes also the tenth, segment fuscous; rarely the entire antenna fuscous; club unusually long as in Fig. 32. Submentum (Fig. 31) triangular, flat, punctures dense separated by slightly less than their diameters; antennal grooves (Fig. 31) moderately distinct. Anterior margin of prothorax feebly emarginate as in Fig. 27. Prothorax with length to width as 1-1.64 (1-1.58 to 1-1.70) and width of prothorax to width of elytra as 1 to 1.1. Pronotal surface tending to be uneven. Lateral margins of prothorax as in Fig. 25, very feebly explanate and reflexed, feebly arcuate. Hind angles of prothorax forming angles of about 115°. Disc of pronotum with punctures separated by less than their diameters, intervals obsoletely granular, each puncture bearing a recumbent golden hair about .05 mm. long.

Elytra conjointly with width to length as 1-1.27 (1-1.23 to 1-1.31), elytral lateral margins more broad and more reflexed than pronotal margins, only the reflexed portion in Fig. 25; apices conjointly truncately rounded; sutural margin feebly dehiscent at tip. Disc of elytra punctate as the prothorax, each puncture bearing a recumbent golden hair .04-.08 mm. long.

Both sexes have mesotibiae and metatibiae with three fine rows of spines and hairs along outer side. The male mesotibiae feebly enlarged apically (Fig. 29) and the male metatibiae very feebly enlarged at apical fifth. Length 2.6-3.5 mm., of holotype male 3.3 mm., of allotype 3.0 mm.

This species differs from the other four species in the shallow emargination of the prothorax, narrower lateral margins of the prothorax, and from all but *eximia* in the feebly expanded male mesotibiae.

Type material: Holotype, male, 2000-3700 ft., Clayton, Georgia, June 1909, C. W. Leng in the author's collection (CTP). Allotype, female, same data as holotype, in the author's collection (CTP).

Paratypes are known from New York, New Jersey, Pennsylvania, District of Columbia, Delaware, West Virginia, North Carolina, South Carolina, Georgia, Alabama, Mississippi, Louisiana and Texas.

New York: New York, Central Park, L. I. (sic), 7 April 1918 (CU); New Jersey: Linwood, 1 July 1944, J. W. Green (CAS), Cape May, 13 July 1930, J. W. Green (CAS); Pennsylvania: state label (MCZ); District of Columbia: Washington 11, 25 April, 2 May (USNM) (CTP); Delaware: Newark, April 1908 (WAC); West Virginia: Smoke Hole, Pendleton Co., 7 August 1930, J. G. Needham (CU); North Carolina: state label (MCZ), Black Mt., 4 July 1940, J. W. Green (CAS); South Carolina: Florence, 30 June 1952, V. M. Kirk (WAC); Georgia: same data as holotype (CTP) (LRG); Florida: Gainsville, 5 April 1939, 28 March 1934, G. B. Merrill (Fla. Plant Board) (CAF); Alabama: Mobile, 21 May 1910, 19 April 1910, H. P. Loding (CAF) (CU), Auburn, 18 April 1940, E. C. Van Dyke (CAS), Daphne, 3 April (CU); Spring Hill, 6 May 1917, H. P. Loding (CU) (CTP); Mississippi: Leakesville, 8 April 1931, H. Dietrich (CU), Lucedale, 29 March 1932, H. Dietrich (CU); Louisiana: Winnfield, 19 May 1916 (HCF); Texas: state label (USNM) (CTP).

Ethology. In contrast to *rufida* and *alternata, lengi* appears in spring and early summer.

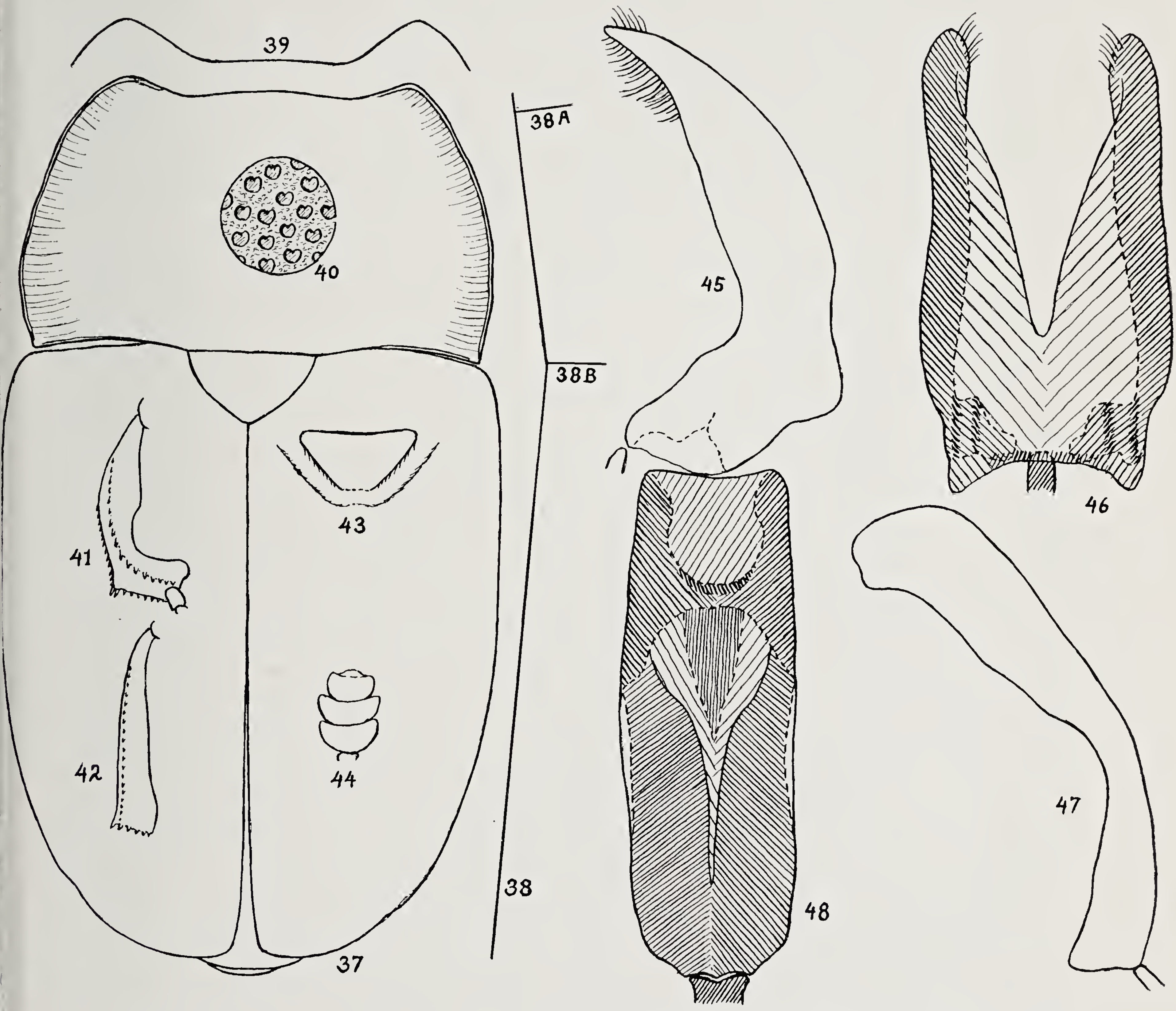
Epuraea alternata new species

(Figs. 37-48)

A large (± 3.8 mm.) convex *Epuraea* with very distinctive mesotibiae in both sexes. Color fuscous, appendages, pygidium, and underside paler.

Vertex with shallow punctures separated by less than their diameters, punctures larger than eye facets. Antennae uniformly fuscous, slightly paler than pronotum but much darker than legs, club as figured (Fig. 44). Submentum (Fig. 43) trapezoidal, feebly convex, punctures very dense, about one-half their diameters apart, antennal grooves moderately distinct (Fig. 43). Anterior margin of prothorax emarginate as in Fig. 39. Prothorax with length to width as 1-1.7 (1-1.55 to 1-1.20) and width of prothorax to width of elytra as 1 to 1.06. Lateral margins of prothorax as in Fig. 37, feebly reflexed, evenly arcuate. Hind angles of prothorax forming angles of about 120°. Disc of pronotum with punctures separated on average by about their diameters, intervals finely granular, each puncture bearing a recumbent golden hair about .06 mm. long.

Elytra conjointly with width to length as 1-1.18 (1-1.06 to 1-1.20); elytral lateral margins as reflexed as pronotal margins, only the reflexed portion indicated in Fig. 37; apices con-



Figs. 37-48. *Epuraea alternata,* male holotype (except Figs. 45-48, which are of male paratype): 37, prothorax and elytra. 38, lateral view of axis of prothorax and elytra. 38A, line of sight for Fig. 39. 38B, line of sight for Fig. 37. 39, anterior margin of pronotum. 40, punctation of disc of pronotum with pubescence omitted. 41, dorsal view of mesotibia. 42, ventral view of metatibia. 43, submentum and antennal grooves. 44, antennal club. 45, lateral view of tegmen. 46, dorsal view of tegmen. 47, lateral view of median lobe. 48, dorsal view of median lobe.

jointly truncately rounded, sutural margin feebly dehiscent at tip. Disc of elytra punctate as the prothorax, intervals finely granular, each puncture bearing a recumbent golden hair about .07 mm. long.

Both sexes have the mesotibiae and metatibiae with three strongly developed ridges with rows of spines and hairs along outer sides, the more dorsal ridge becoming entirely dorsal apically. Male mesotibiae (Fig. 41) enlarged apically more than in any other Holarctic *Epuraea* known to the writer. The male metatibiae are feebly enlarged at apical fourth (Fig. 42). Length 3.00-3.9 mm., of holotype male 3.9 mm.

This species is closely related to *rufida* but *alternata* differs in being more convex, especially the prothorax, the anterior angles of the prothorax more approximate resulting in more arcuate lateral margins, upper surface slightly less densely punctate, apices of elytra more truncate because sutural angles are less rounded, and less elongate in outline. Also *alternata* has more extremely developed male mesotibiae (Fig. 41) and different male metatibiae (Fig. 42).

Type material: Holotype, male, on rotting peach 29 September 1950 at College Park, Maryland, G. H. Nelson in the M.C.Z. (C. A. Frost coll.). Allotype, female, same data as holotype in G. H. Nelson collection. Also 115 paratypes as follows.

This species is known from Vermont, New York, Pennsylvania, Maryland, Delaware, Virginia, North Carolina, Tennessee, Ohio, Indiana, Michigan, Wisconsin, and Kansas.

New York: Geneva, 31 August 1954, W. A. Connell (WAC); Pennsylvania: Wind Gap, 28 June 1941, J. W. Green (CAS); Maryland: Myersville, 18 June 1955, W. A. Connell (WAC), Beltsville, 21 September 1954, W. A. Connell (WAC) (CTP), series with same data as holotype (GHN) (WAC) (CTP), Hancock, 6 September 1956, W. A. Connell (WAC) Edgewood Arsenal, 24 June, 1, 5 July 1969, A. & A. Gillogly, in Alan Gillogly coll. Delaware: Newark, 30 May-3 November, chiefly June and September, W. A. Connell (WAC) (CNC) (CTP), Laurel, 14 May 1932, L. L. Williams (WAC); Virginia: Alexandria Co., 22 June 1920; North Carolina: Black Mts., 14 June (LRG); Tennessee: Chilhowee Mts., 28 June, 20 October 1954 (HFH); Ohio: Mad T., Pickaway Co., 25 October 1931, E. S. Thomas (LRG); Indiana: Marion Co., 7 June 1929 (CU); Knox Co., 7 June 1937, J. M. Amos (WAC); Michigan: E. S. George Reserve, Livingston Co., 19 September 1947, K. Bohnsack, in his collection; Wisconsin: 14 June, 1, 7, 13 July, 17, 24, 31 August 1954, at Univ. of Wis. campus, Dane Co. (Un WIS) (CTP); Missouri: St. Louis, 10 October 1948, W. S. Craig (CAF); Kansas: Lawrence, L. W. Brown (atypical so not a type) (CNC).

Ethology. The adults occur chiefly in June and again in the fall. It has been taken at flowers of *Lornicera*, apple drops, in banana trap, in pawpaw, at sap flow, at rotting melon and peach, at sap of chestnut oak ex rotting *Conopholis americana*. Vermont: Manchester, 11, 17 August 1969, C. Parsons (CTP);

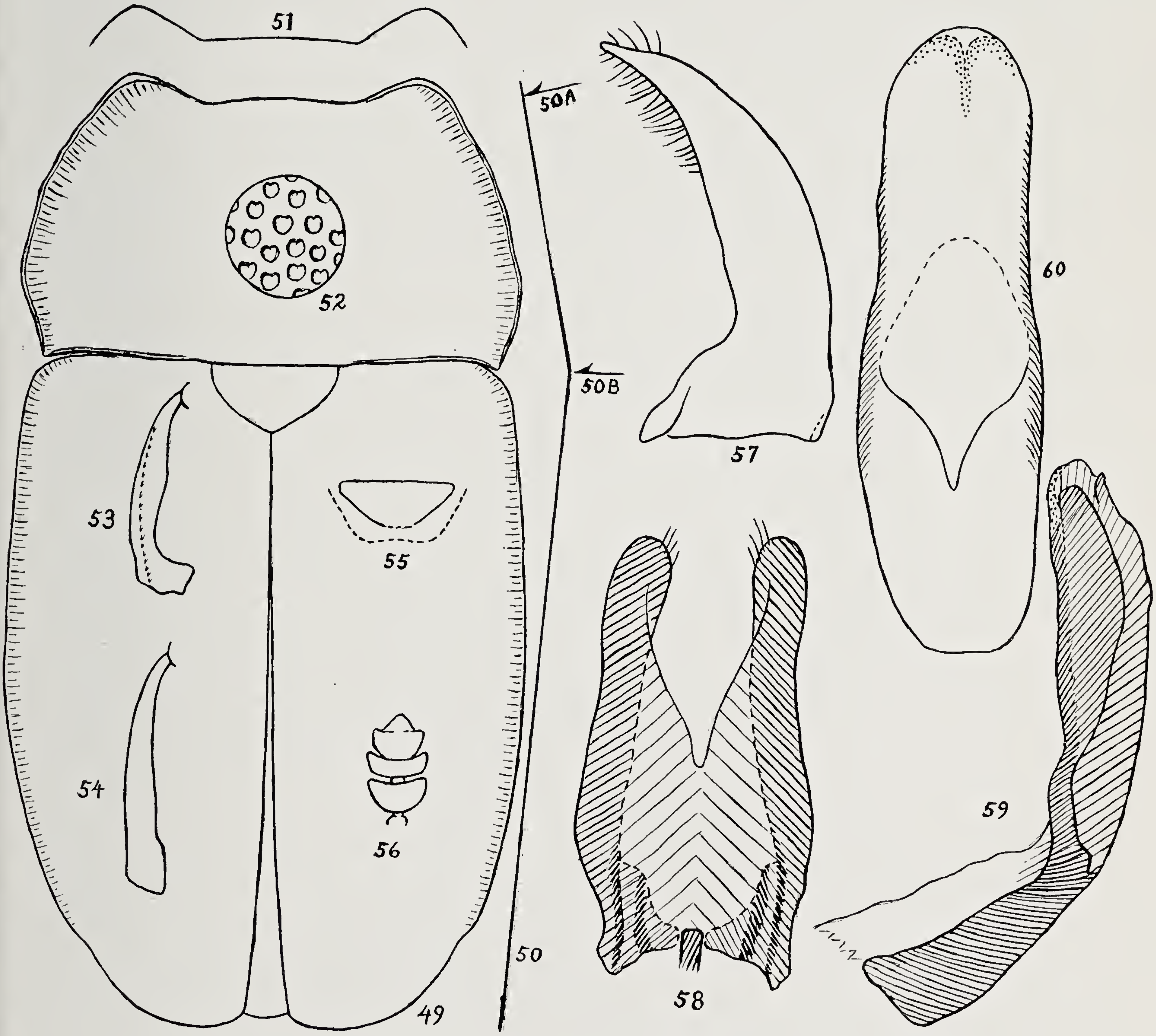
Epuraea rufida (Melsheimer)

(Figs. 49-60)

Omosita rufida Melsh., 1846, Proc. Acad. Nat. Sci. Philadelphia, 2, 106.

A large (± 4 mm.) convex *Epuraea* with greatly expanded male mesotibiae. Color uniformly fuscous except that the legs may be distinctly more pale.

Vertex with punctures separated by less than their diameters, punctures larger than eye facets. Antennae fuscous but may become paler basally, club as figured (Fig. 56), usually the ninth and tenth segments more separated. Submentum (Fig. 55) indistinctly trapezoidal, feebly convex, punctures very dense, about one-half their diameters apart, the male with tuft of golden hair in center at anterior margin. Anterior margin of prothorax emarginate as in Fig. 51. Prothorax with length to width as 1-1.6 (1-1.55 to 1-1.67) and width of prothorax to width of elytra as 1 to 1.06. Lateral margins of prothorax feebly arcuate, narrowly explanate, very feebly reflexed as in Fig. 49. Hind angles of prothorax forming an angle of about 110°.



Figs. 49-60. *Epuraea rufida,* male neotype. 49, prothorax and elytra. 50, lateral view of axis of prothorax and elytra. 50A, line of sight for Fig. 51. 50B, line of sight for Fig. 49. 51, anterior margin of pronotum. 52, punctation of disc of pronotum with pubescence omitted. 53, dorsal view of mesotibia. 54, dorsal view of metatibia. 55, submentum and antennal grooves. 56, antennal club (not from neotype). 57, lateral view of tegmen. 58, dorsal view of tegmen. 59, lateral view of median lobe. 60, dorsal view of median lobe. Note: Figures 4, 9, 10, 11, 12, 16, 21, 23, 24, 28, 33, 34, 35, 36, 40, 45, 46, 47, 48, 52, 57, 58, 59, 60 enlarged 3x the other figures.

Disc of pronotum with punctures separated by about one-half their diameters, intervals finely irregularly granular, each puncture bearing a recumbent golden hair about .04 mm. long

Elytra conjointly with width to length as 1-1.3 (1-1.26 to 1-1.36), elytral lateral margins about as reflexed as pronotal margins, only the reflexed portion shown in Fig. 49 apices conjointly truncately rounded, sutural margin at tip very feebly dehiscent. Disc of elytra punctate as the prothorax, intervals finely granular, each segment bearing a recumbent golden hair about .06 mm. long.

Both sexes have the mesotibiae and metatibiae with three rows of spines and hairs along outer sides but much less developed than in *alternata*. The male mesotibiae and metatibiae enlarged as in Figs. 53, 54. Length 2.7-4.7 mm. of neotype male 4.5 mm.

For comparisons with *rufida* see under the other species.

Type material: Male from Pennsylvania, in the Mus. Comp. Zool. (Leconte collection), is here designated the neotype. Since Leconte removed many of Melsheimer's types to his collection, underlined the "Mels." on the label, and no *rufida* are now in the Melshiemer collection, this neotype specimen is very likely a syntype.

This rare species is known from Quebec, New York, Pennsylvania, Ohio, Maryland, North Carolina, and Alabama.

Quebec: Chelsea, 21 April, W. J. Brown (CNC); New York: Clermont, 5 November 1934, H. Dietrich (CTP); Pennsylvania: state label (MCZ, Leconte coll.); Ohio: Athens, 18 April 1936, W. Stehr (LRG); Maryland: Cabin John, Potomac River, 1 April 1951, G. H. Nelson (GHN), 2 miles east of Silver Springs, N. W. Branch, 21 October 1950, G. H. Nelson (GHN) (USNM) (CAF) (Univ. of Calif. at Davis) (CTP); North Carolina: July, Black Mts. (AMNH); Alabama: June, Monte Sane, Madison Co. (LRG).

Ethology. This is evidently a spring and fall species. G. H. Nelson collected the Cabin John specimen under hickory bark and the series at Silver Springs at "black gummy fungus blisters under oak bark".

A new species of *Gerstaeckeria* in Peru, first record for South America (Coleoptera, Curculionidae)

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INTERNATIONAL PROGRAMS IN AGRICULTURE
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The genus *Gerstaeckeria* is widespread in the new world but not previously recorded from South America. Species are known from Canada, the United States, Mexico, Guatemala, the West Indies, and the Galapagos Islands.

In 1967 I found four specimens in the collection of the California Academy of Sciences of a new species of *Gerstaeckeria* from coastal "lomas" in Peru. While I was in Peru in 1968, Dr. Pedro Aguilar took me to some "lomas" north of Lima where more than 1000 weevils were collected. "Lomas" are low hills which because of their elevation have vegetation in an otherwise completely barren desert. Condensation from the seasonal fogs provides sufficient water for a variety of plants.

The dominant plant in the area where the weevils were collected was a species of Portulacaceae *Calandrinia ruizi* MacBride, which had succulent leaves that in most cases showed evidence of extensive feeding by weevils. The weevils were abundant under stones, but were found in very great numbers under pads of dry cow dung. As many as 87 specimens were taken under one pad of dung. There were no cacti in the immediate area where the specimens were collected, and this seems significant as all *Gerstaeckeria* previously have been associated with cactus. The weevils are apterous and the large number collected in the area would seem to indicate a host other than cactus for this new species. I hope that it will be possible to determine the host in the future.

Specimens were kept alive and fed on samples of the Portulacaceae for two weeks and then they were placed on a Chilean species of *Opuntia* on which they fed and lived for four months longer.

Gerstaeckeria Champion

Gerstaeckeria Champion, 1905, Biologia Centrali-Americana, Coleoptera, 4 (4): 470.

Type-species: *Acalles bifasciatus* Gerstaecker, 1860, Stettiner Entomol. Zeit. 21:393. Designated by Champion loc. cit.

Body robust, clothed with scales. Rostrum approximately as long as pronotum, received in deep groove in prosternum and mesosternum. Eyes partially covered by ocular lobes when rostrum rests in sternal groove. Antennae with the 7 funicular segments coarsely pubescent; club densely finely pubescent; scrobes directed toward base of eyes. Pronotum wider than long, strongly punctate.

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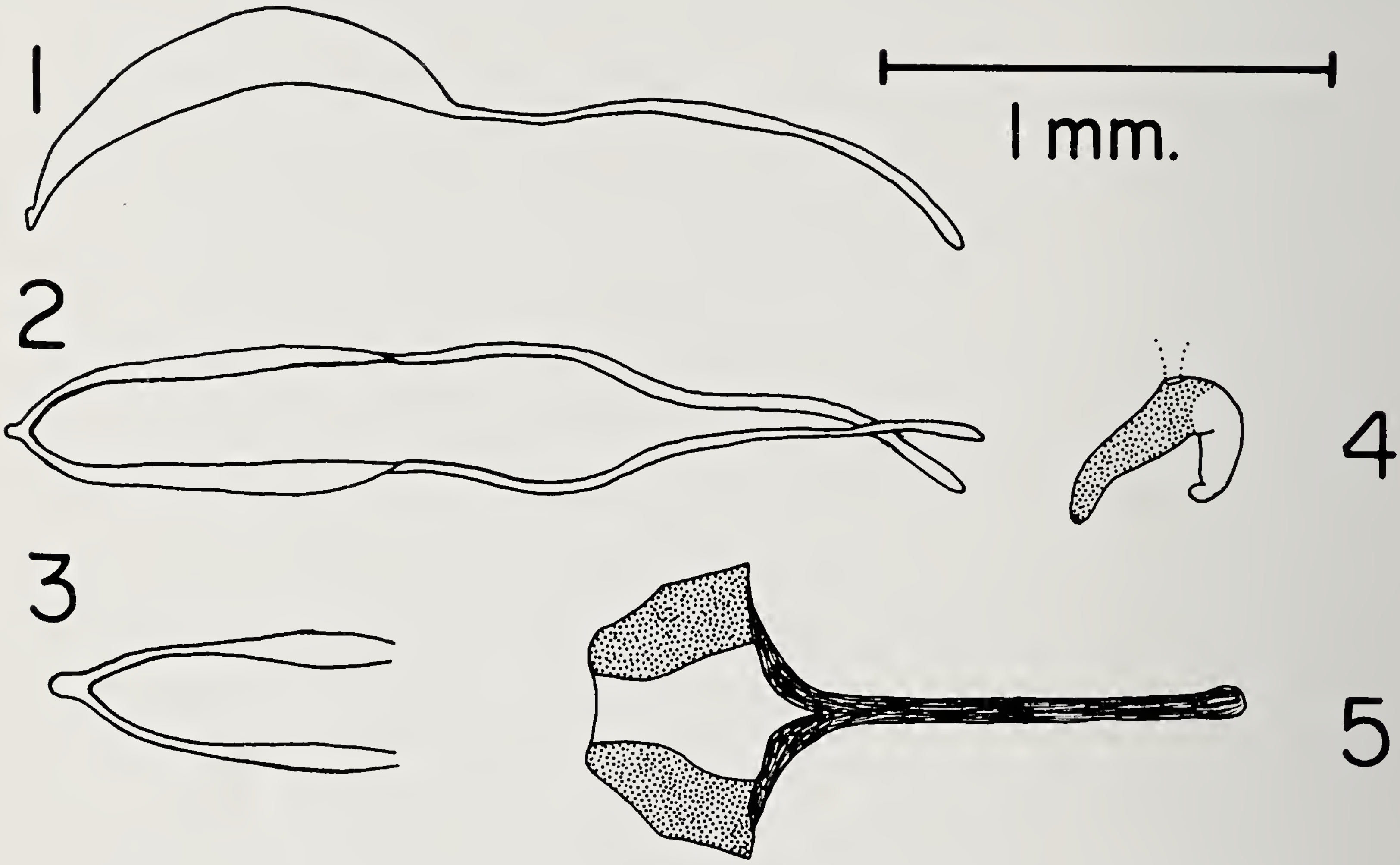
[1] Submitted as Journal Paper No. 3824, Purdue University Agricultural Experiment Station, Lafayette, Ind.

Scutellum not visible. Elytra striate, strial punctures always distinct, each with a single scale; humeri lacking; suture fused; hind wings lacking. Ventral abdominal segments 2 through 4 subequal; with deep straight sutures. Femora unarmed; all tibiae uncinate; hind tibia with praemucro. Tarsi with fine ventral pubescence; tarsal claws simple.



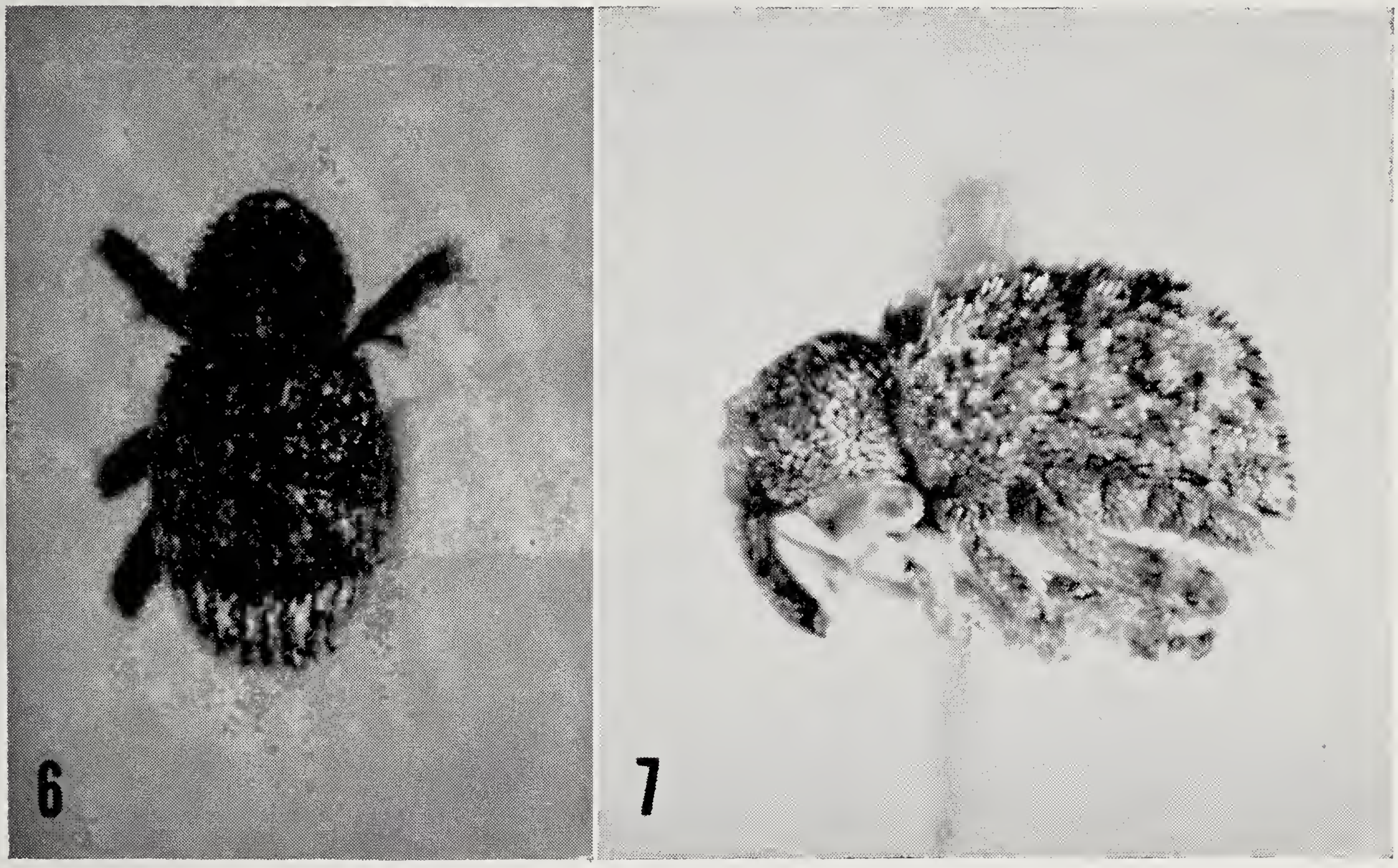
FIGURES 1-5. *Gerstaeckeria peruana* n. sp. 1. aedeagus, lateral view. 2. aedeagus, dorsal view. 3. aedeagus, dorsal view of apex. 4. spermatheca (stippling indicates reticulate surface). 5. female eighth sternite (stippling indicates degree of sclerotization).

Gerstaeckeria peruana NEW SPECIES

Black, clothed with recumbent and erect white, brown, and black scales. rostrum broad, stout; basal half carinate with very coarse deep dense punctures, punctures less coarse, less deep, and sparser towards apex; basal third clothed with dense erect broad scales; apical two-thirds clothed with progressively sparser and finer setae. Scrobes deep, lateroventrae. antennae inserted at basal third of rostrum; reddish brown; club oval, less than twice as long as wide. head densely clothed with recumbent to suberect brown, black, and white scales; with deep, coarse, dense punctures; frons lacking fovea and clothed with erect to suberect white scales. prothorax with a weak median carina; with coarse deep punctures, a few confluent; scales erect or suberect. elytra with sides subparallel, narrowing towards apex, moderately convex; strial punctures round to elongate oval; intervals all evenly elevated, wider than strial punctures; densely clothed with recumbent and erect brown, white, and black scales; erect scales usually at least one-third longer than recumbent scales; lacking distinct posthumeral vittae; distinct white postmedian fascia. venter evenly clothed with dense pale brown scales; punctures deep, coarse, and dense; apex of fifth abdominal segment with coarse to fine setae. legs with femora annulate with white and dark brown scales; tibiae clothed mainly with white scales, with a sub-basal dark brown area, outer apical area with a double setal comb; third tarsal segment more than one-third wider than second; claws widely divergent.

This species is more closely allied to the Mexican and U. S. species than to those of the Galapagos and West Indian Islands. The genitalia are similar to though distinct from those of *opuntiae* Pierce (1912) and *basalis* Leconte (1876) but they can be readily separated from these and related Mexican species because of the unusual scales on the elytra. No other related species has the short recumbent scales combined with the elongate erect scales except *mutillaria* (Gerstaecker) (1860), and in this species the scales are even more greatly elongated and black and white only, causing this species to resemble a hairy mutillid.

There is a wide range of color variation. The commonest color pattern is a somewhat tessellate appearance with a distinct postmedian fascia or pair of fasciae. There are, however, rather pale colored individuals in which the fasciae are barely visible. Various intermediate color patterns are also to be found among the specimens before me.



FIGURES 6-7. *Gerstaeckeria peruana* n. sp. 6. Holotype male, dorsal view. 7. Allotype female, lateral view.

For the 1022 specimens on hand the range in length is 3.5 to 6.4 mm. Approximately 90% of these specimens lie between 4.0 and 5.5 mm. The holotype male, allotype female, and numerous paratypes are in my personal collection. Paratypes also are in the following collections: Dr. P. G. Aguilar, F., Universidad San Marcos, Lima, Peru; American Musuem of Natural History; Dr. Horace Burke, Texas A. & M.; California Academy of Sciences, San Francisco; Field Museum of Natural History, Chicago; La Molina, Universidad Agraria, Lima, Peru; Dr. E. L. Sleeper, Long Beach State College, Calif., and the United States National Museum.

HOLOTYPE: PERU, Lachay, *circa* 80 km. N. W. Lima, VII-23-1968, costal loma, under dry cow dung, L. and C. W. O'Brien.

Body length: 4.2 mm. Male.

ALLOTYPE: Same data.

Body length: 5.2 mm. Female.

PARATYPES: Same data (904 specimens); Same data, collector P. Aguilar F. (112); 2 km. south Lachay, *circa* 78 km. N. W. Lima, VII-23-1968, cactus area, under stones, L. and C. W. O'Brien (2); 12 miles S. E. of Camana, S. W. Peru, IV-3-1951, E. S. Ross, stones, coastal loma (3); 40 miles S. of Nasca, Peru, IV-1-1951, E. S. Ross, coastal loma (1).

I wish to gratefully acknowledge the invaluable assistance of Dr. Pedro Aguilar, without whose help it would have been impossible to succeed in my search for *Gerstaeckeria* in Peru in the short time available. I should also like to thank Dr. Ross Arnett of Purdue University for his assistance with the photographs in this paper.

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The Genus *Pandeleteinus* Champion with the Description of a New Species from Mexico (Curculionidae, Tanymecini)[1]

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HISTORY

When Schaeffer (1908, p. 216) described *Pandeleteius submetallicus* he stated quite frankly that it looked "somewhat strange" in *Pandeleteius.* Champion (1911, p. 206) described the genus *Pandeleteinus* for *submetallicus* Schaeffer and until 1959 it remained the only species assigned to the genus. At the same time that he removed *submetallicus* from *Pandeleteius,* Champion noted (1911, p. 186) that *Pandeleteius ovipennis* Schaeffer also differed from his concept of

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[1] This is the fifth paper in a series on the Tanymecini.

Pandeleteius, and, indeed, on p. 175 of the same volume, Sharp had already removed *ovipennis* to his new genus *Isodacrys.*

Shortly thereafter Pierce (1913, p. 402) stated that, "The available characters do not seem to the writer to warrant making three genera out of *Pandeleteius* for our North American species, as suggested by Champion". Pierce then synonymized *Pandeleteinus* but let *Isodacrys* stand (p. 401).

Van Emden (1936, p. 224, note 5 [in German], and 1944, p. 572, note 61 [same note in English]) described the actions of Champion and Pierce and remarked that *Pandeleteius submetallicus* would come to *Hadromeropsis* or *Pandeleteius* in his key, depending on whether greater importance was attributed to the contiguous fore coxae or to the enlarged legs. He himself expressed *no opinion* on the taxonomy saying he had not seen *submetallicus.*

Voss (1954, pp. 227, 228, 232) removed *submetallicus* from *Pandeleteius* to a subgenus of *Hadromeropsis* interpreting Van Emden (l. c.) as showing that the species must be transferred to the genus *Hadromeropsis* on the grounds of contiguous fore coxae. Voss, too, had not seen *submetallicus.*

In 1959, I redefined the genus *Pandeleteinus* (1959, pp. 364-382) and described three additional species. Unfortunately, I had not seen Voss' 1954 paper before hand. Upon reviewing my paper, Voss (in litt.) suggested that his treatment of *Pandeleteinus* should be changed.

Like previous workers I relied heavily upon the narrowly separated fore coxae and scarcely enlarged fore legs to justify the genus. Now a much more satisfactory and exclusive character has been found which strengthens the generic definition.

GENERIC CHARACTERISTICS

The characters of the anterior portion of abdominal ventrites 3, 4, and 5 are valuable on a generic and sometimes a specific level in Tanymecini. In *Pandeleteinus* this region is modified as follows: ranging from slightly and gradually depressed to abrupty trough-like; never carinate on the edge; never completely reaching the sides; weakest and usually glabrous on ventrite 3, progressively stronger and always glabrous on ventrites 4 and 5. Within the genus the modification is least developed in *submetallicus* and *elytroplanatus* Howden where it is a slight, arcuate depression well removed from the sides; in the other three species, *lucidillus* Howden, *magdalenensis* Howden, and *subcancer* n. sp., the modification is much stronger but the extreme side margins suddenly become flat and squamose. The modifications are similar in both sexes.

The genus *Pandeleteius,* some of whose species are perhaps most apt to be confused with *Pandeleteinus,* has the anterior portion of ventrites 3, 4, and 5 usually flat and unmodified, rarely with a partly glabrous and obsoletely arcuate depression.[2] *Hadromeropsis* likewise has no modification of this region but like *Pandeleteius* may have the posterior edges of ventrites 2, 3, and 4 abruptly modified. The genus *Isodrusus* has the anterior modification stronger than in *Pandeleteinus,* and the genus *Isodacrys* has the modification ranging from very weak to more strongly developed than in *Pandeleteinus.*

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[2] *Pandeleteius subtropicus Fall,* in which the abdominal modification is stronger than in *Pandeleteinus,* does not belong to the genus *Pandeleteius* but to a common West Indian genus. See "Tanymecini of the West Indies", Howden, in press.

Thus the genus *Pandeleteinus* can always be recognized by the form of the anterior portion of ventrites 3, 4, and 5, in combination with its scarcely enlarged fore legs; narrowly separated fore coxae; its slender, arcuate aedeagus; and its broad beak with parallel and vertical sides.

The distribution of the genus is shown in the map.

KEY TO THE SPECIES OF PANDELETEINUS

1. Ocular vibrissae absent or vestigial, i.e., reduced to 1 to 3 hairs which end well before the eyes. Fore tibiae usually non-dentate 2
   Ocular vibrissae well-developed, i.e., consisting of a cluster of 3 or more setae of various lengths, some of which reach eye or nearly so. Fore tibiae with distinct teeth on inner edge 3
2. Thorax distinctly longer than broad. Color cinereus with darker markings. Mexico south of the Tropic of Cancer .... **subcancer** n. sp.
   Thorax as broad or broader than long. Color metallic green, gold, or blue, or immaculate or nearly immaculate tan. Southwestern United States .... **submetallicus** (Schaeffer)
3. Elytra of both sexes two and a half to three times as long as thorax. Dorsal surface of elytra in lateral profile flat, elytra of about equal thickness behind humeri. Setae of dorsal surface decumbent, minute, and inconspicous. Elytra without oblique fasciae. Western Texas, New Mexico, southeastern Arizona .... **elytroplanatus** Howden
   Elytra of female slightly more than twice as long as thorax; elytra of male less than twice as long as thorax. Dorsal surface of elytra in lateral profile arcuate, elytra much thicker apically than behind humeri. Setae of dorsal surface recurved and of moderate size. Elytra with oblique fasciae which are not always prominent 4
4. Mature color maculate brown. Margins of elytra gently sinuous, constricted at base of third abdominal segment. Middle coxae separated by same distance as fore coxae. Baja California .... **magdalenensis Howden**
   Mature color maculate piceous. Margins of elytra nearly straight, only slightly indented at base of third abdominal segment. Middle coxae slightly more widely separated than fore coxae. Southern Arizona, western Sonora, east-central Baja California .... **lucidillus** Howden

Pandeleteinus subcancer n. sp.

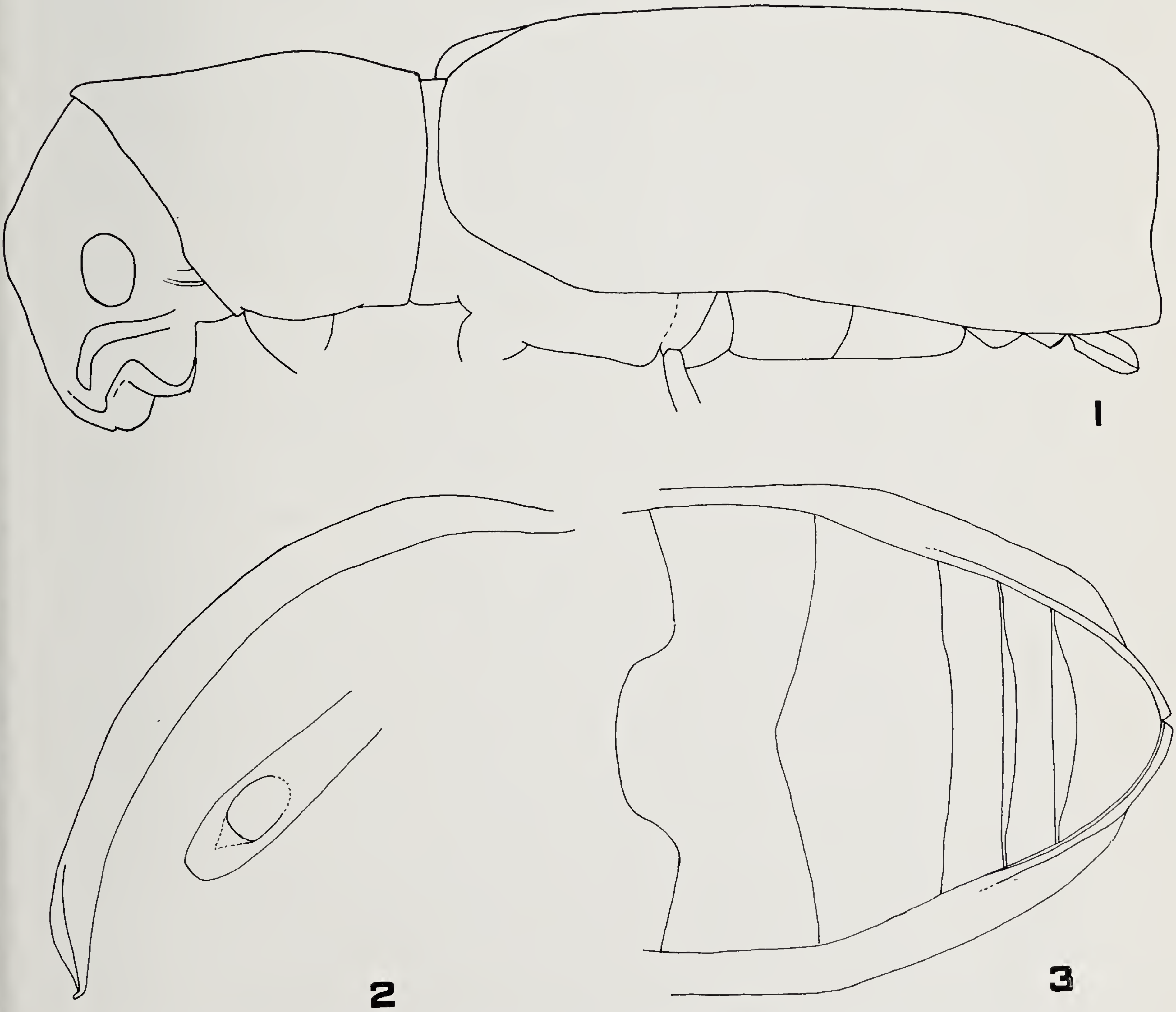
Figures 1, 2, 3

Holotype, male, length 3.4 mm., width 1.3 mm. Some small patches of scales abraded, missing tarsal claw on right fore leg, and abdomen slightly dislocated. Covered with pale cinereus scales; disc of elytra with some mottling and a darker, indistinct "V" on apical third. Scales contiguous, finely granular; scales of head and prothorax margined, often pustulate; apical two or three rows of scales simpler; scales of elytra margined posteriorly, becoming pustulate towards apex, those of summit of declivity strongly convex, shiny, circular, with weak margins. Setae of dorsal surface inconspicuous, about as long as one scale, slightly arched, their tips touching the surface. Setae of frons and beak to interantennal line conspicuous, longer, strongly arched, their tips touching the surface; setae apicad of interantennal line rapidly becoming erect towards apex and median line.

In profile head flat to frontal prominence which is gently rounded and continuous with flat beak; eye approximately one-fourth closer to ventral surface than to dorsal surface. Beak very slightly narrower than head between eyes, sides parallel, apparently quadrate but actually approximately 1.3 times wider than long. Median line finely impressed from between middle of eyes to interantennal line which is unmarked. Apical emargination approximately right-angled, occupying approximately one-half of apical margin; a row of seven vibrissae each side of epistoma. Epistoma with median indentation. Scrobe obtusely, gently angled; deep throughout to ventral surface. Antenna short, club as long as eye. Eye subelliptical, nearly evenly convex.

Prothorax 0.86 times as wide as long; slightly, gently convex dorsally and laterally between the basal and apical constrictions; apex very slightly wider than base; widest at middle. Ocular vibrissae represented by a single long vibrissa.

Elytra across humeri 1.4 times wider than apex of thorax, 1.1 times wider than thorax at its widest. Elytra 2.26 times longer than thorax. Elytra with sides very slightly divergent to middle, thence gradually convergent, rounded to apex. Interval 5 slightly produced at summit of declivity, coalescing with intervals 4 and 6 well below summit, the junction not visible from dorsal view. Elytra in profile with dorsum weakly arcuate; declivity vertical, its



FIGURES. 1-3, *Pandeleteinus subcancer* n. sp. 1, profile of female; 2, lateral view of aedeagus and dorsal view of apex of aedeagus; 3, ventral view of abdomen of female.

summit rounded and directly above apex, obsoletely concave. Sutural interval at summit of declivity enlarged, covered with modified scales as noted above and with additional setae. Strial punctures moderate, separated by a little more than their own diameter. Elytral intervals approximately equal, slightly convex, set with a single row of setae.

Fore leg scarcely enlarged; fore femur exactly as long as hind femur, 1.2 times wider than hind femur. Fore tibia with neither teeth nor denticles on inner edge.

Fore coxae very close, separated by less than the narrowest width of the scape; middle coxae separated by a distance about equal to the narrowest width of the scape. Margins of elytra in ventral view (Fig. 3) scarcely constricted at ventrite 3. Ventrites 1 and 2 flat; ventrite 3 with its posterior edge gently deflected, thence abruptly perpendicular and glabrous for a brief distance; ventrite 4 transversely convex, its posterior edge more broadly perpendicular, much higher medially; ventrite 5 convex with sides flattened anteriorly, its apex broadly truncate and not margined. Modification of anterior portion of ventrites 3, 4, and 5 abrupt, deep, glabrous, almost reaching sides, very narrow on ventrite 3, wider medially on ventrite 4, and much wider medially on ventrite 5.

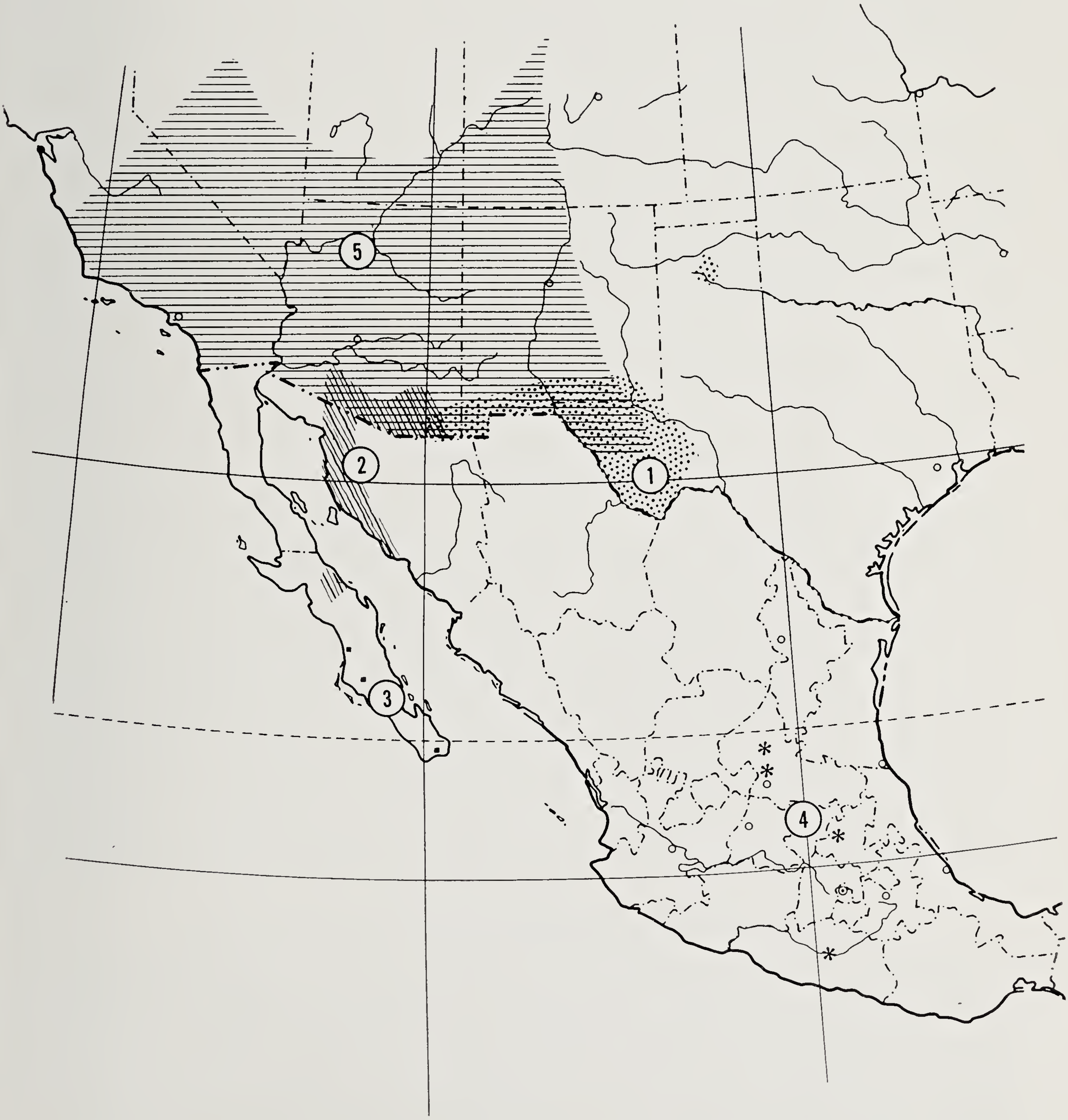
Aedeagus (Fig. 2) not as perfectly cylindrical as in other *Pandeleteinus*, slightly flattened, the central third in dorsal view gradually narrowed. Apex of aedeagus slightly reflexed, briefly truncate.

Allotype, female, length 3.5 mm., width 1.4 mm. More markings than in the type: a faint, dark, median vitta on frons, head and pronotum; sides of pronotum with a broader dark vitta; elytra conspicuously white behind apical V. Beak proportionately broader than in type, head more robust. Median line of beak ending in a weak transverse fovea. A row of four vibrissae each side of epistoma. Eye slightly larger; antennal club shorter than eye. Prothorax with a second shorter ocular vibrissa on each side. Fore and middle coxae separated by same distances as in type. Ventrite 5 with its apex broadly rounded, weakly margined.

Holotype, male, 19 mi. N. San Luis Potosi, S. L. P., Mexico, 1 September 1958, on mesquite, E. Mockford (Howden). Allotype, female, same data as type (Howden). Paratypes: 36 males, 40 females. GUERRERO: 1 male, 18 mi. N. Chilpancingo, 26 August 1958, H. F. Howden (CNC No 10547). HIDALGO: 2 males, 4 females, 20 mi. S. Zimapan, July 1954, D. G. Kissinger (Kissinger). SAN LUIS POTOSI: 18 males, 13 females, same data as type but some H. F. Howden, some on mesquite, 2 on greasewood (CNC, Howden); 15 males, 23 females, 46 mi. N. San Luis Potosi, 1 September 1958, H. F. Howden or E. Mockford, some on mesquite, 1 on yucca (CNC, Howden).

The male paratypes range in length from 2.8 to 3.8 mm., and in width from 1.1 to 1.3 mm.; female paratypes range in length from 3.4 to 4.1 mm., and in width from 1.3 to 1.8 mm. The color and markings usually range between that of the type and allotype; the elytral V is always indicated if not distinct. A few specimens are more brown than gray, and some have most of the ventral scales non-metallic bluish. In one atypical female from the type locality most of the scales of the elytra are without margins and are more convex than pustulate. Some specimens have as many as the first four rows of scales beyond the apical emargination modified: not margined, white, shiny, more convex, but still slightly granular. The apical emargination is quite variable, ranging from right-angled through ogival to arcuate. Thirty-two percent of the specimens have one vibrissa on each side, 32% have two vibrissae on each side, 15% have three vibrissae on each side and the remainder have a different number of vibrissae on each side, some of the variation obviously due to abrasion. The profile of the elytral declivity varies, regardless of sex, from straight with the apex of the elytra directly beneath the summit of the declivity to concave with the apex extending distinctly beyond the summit. In three specimens the fore tibiae each have two small denticles. The very distinctive aedeagus is identical in all specimens examined.

Pandeleteinus submetallicus like *subcancer* has vestigial vibrissae and often non-dentate fore tibiae. However, this northernmost species remains the most distinctive of *Pandeleteinus* with its spherical head, cup-shaped prothorax, and immaculate metallic green or vaguely mottled tan coloring.



Map 1. Distribution of *Pandeleteinus*. 1, *elytroplanatus* Howden; 2, *lucidillus* Howden; 3, *magdalenensis* Howden; 4, *subcancer* n. sp.; 5, *submetallicus* (Schaeffer).

Pandeleteinus subcancer resembles *magdalenensis* in habitus, especially in the shape of the elytral declivity. In addition to the diagnostic characteristics, *magdalenensis* differs in having the sides of the elytra strongly constricted at the base of ventrite 3; the aedeagus cylindrical with the apex broadly rounded; strial punctures larger and more distant, hence only two-thirds as numerous; fore coxae more widely separated.

According to H. F. Howden the entire series from 19 mi. N. San Luis Potosi was collected between 4:30 and 5:30 P.M., all but two on mesquite. The series from 46 mi. N. of San Luis Potosi was collected after 6:30 P.M. all but one on mesquite.

The name *subcancer* refers to the geographical range of the species.

Pandeleteinus elytroplanatus Howden, 1959, pp. 378-382

The type locality of *elytroplanatus* is near Presidio, Texas, and the type series includes locations in Texas from the Big Bend north to Pecos as well as in southern Arizona and New Mexico. The range is extended considerably into the panhandle of Texas by a series of 16 specimens from Palo Duro Canyon State Park collected in June, 1959, by H. F. Howden and E. C. Becker. The specimens were taken by beating mesquite (*Prosopis glandulosa*).

Pandeleteinus lucidillus Howden, 1959, pp. 372-375

Pandeleteinus lucidillus was described from southeastern Arizona; recent collections from Arizona and Mexico almost connect the type locality with the single Baja California record. E. L. Sleeper took series near Ajo, near Gila Bend, and at Organ Pipe National Monument, Arizona, in May and at Baja San Francisquito, Sonora, in June. Six specimens were taken at Guaymas, Sonora, in June on *Neltuma* (*Prosopis*) *glandulosa* by Andrew Moldenke. The Baja California specimen is from Santa Rosalía, southwest of Guaymas across the Gulf of California. This specimen was reborrowed from the California Academy of Sciences and compared with the Sonora and Arizona specimens. It has a broader thorax than most specimens but there are two specimens (one male, one female) from Arizona with the thorax as broad. The relative width of the thorax cannot be correlated with sex or locality in the additional 69 specimens seen since the species was described. The thorax ranges from 1.07 to 1.27 times longer than wide.

Pandeleteinus magdalenensis Howden, 1959, pp. 375-378

The range of *Pandeleteinus magdalenensis* has been extended from the Magdalena Plain southward to the extreme tip of Baja California. E. L. Sleeper collected the species at San José del Cabo and a few other localities within the range; Sleeper says (in litt.) that the specimens were taken on "two species of *Acacia,* both species of *Cercidium,* and from a ubiquitous tree, Guamuchil, which is *Pithocelobium dulce,* and I have two specimens from near your type locality (Santo Domingo) from Honey Mesquite".

The San José del Cabo specimens exhibit the following variation. Males range in length from 2.8 to 3.2 mm., and in width from 1.0 to 1.3 mm.; females range in length from 3.0 to 3.6 mm., and in width from 1.3 to 1.5 mm. The brown color is sometimes much lighter, but with the white elytral fascia still distinguishable. The aedeagus is consistently blunt at the apex as illustrated for the type.

Pandeleteinus submetallicus (Schaeffer), 1908, p. 216

The range of the wide-spread *Pandeleteinus submetallicus* has not been extended but a series of specimens has been taken by the author in Wayne County, Utah, an area from which it was previously unrecorded. The species seems to be locally common and undoubtedly occurs throughout its seven state range wherever *Juniperus* and the proper conditions occur.

ACKNOWLEDGMENTS

The following persons loaned the specimens used in this study: E. C. Becker, Entomology Research Institute (CNC); David G. Kissinger, Atlantic Union College; Hugh B. Leech, California Academy of Sciences; Andrew Moldenke, Stanford University; and E. L. Sleeper, California State College, Long Beach. Their assistance is gratefully acknowledged.

My husband, Henry, assisted in the study in many ways and his help is greatly appreciated.

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New Publication

BRIGHT DONALD E., JR. 1969. Biology and Taxonomy of Bar Beetle in the Genus *Pseudohylesinus* Swaine (Coleoptera: Scolytidae), pp. 46, figs 65. University of California Publications in Entomology, vol. 54. University of California Press, Berkeley, Cal. Price $2.00.

In this monograph twelve species and subspecies of the genus *Pseudohylesinus* Swaine are recognized. The first part of the publication consists of a general description of the genus, its history, biology, ecology, and natural enemies. This is followed by a key to the adults. Then each species is redescribed along with a listing of its known distribution and host plants.

N. M. D.

A New Species of *Mayetia* (Coleoptera Pselaphidae) From Northern California[1]

LYNN A. ROYCE and DAVID H. KISTNER

SHINNER INSTITUTE FOR THE STUDY OF INTERRELATED INSECTS

DEPT. OF BIOLOGY
CHICO STATE COLLEGE
CHICO, CALIFORNIA 95926

The purpose of this paper is to describe a new species of the genus *Mayetia* from northern California.

This species was collected in Bidwell Park, (Butte Co., Chico) in an experimental plot established in 1950 by the honorary biological fraternity of Chico State College, Omicron Theta Epsilon. This plot was set up for the purpose of a 5-year study of the effect of sheep grazing on the wildflower population of Bidwell Park. The 2-acre plot was enclosed by a barbed-wire fence and is being compared with a 2-acre open plot at the northern boundary of Bidwell Park. This is the only new species so far described from the enclosed plot, which is now referred to as the Omicron Plot.

Mayetia skeeteri new species

(Figures A-C)

This species along with other West Coast species can be distinguished from members of the genus *Mayetia* Mulsant & Rey occurring in other parts of the United States by the lack of sensory structures with the exception of the cone and specialized setae on the fourth segment of the maxillary palp (Schuster 1960 and 1961).

This species is distinct from others of the Western United States group in the shape of the aedeagus, which is a simple slender tubular structure pointed apically. There is a median process on it which seems to lie at right angles to the rest of the structure. It resembles most closely the aedeagus of *M. grayae* Schuster except that the apical end is pointed, not broadly rounded as in *M. grayae.*

Head lacking eyes, with 60-70 setae on the dorsal surface. Tubercles located at the base of the antennae and head. Clypeus short and transverse. Labrum tridentate. Each mandible with an M-shaped tooth, the right tooth with rounded points of unequal lengths, the left tooth with sharp points of equal length. Ventral surface of the head flat; the gular fovea with tentorial connections to the vertexal foveae. Mentum with 2 integumental projections anterior to a pair of setae. Circular mark and 2 setae occur on the head capsule posterior to the mentum. Maxillary palpus with 4 segments; 1 macroseta on segment 3, segment 1 minute, 2 pyriform, 3 globose, and 4 ovoid with a minute straight palpal cone and 2 thin hyaline setae midway on outer margin. Antennae 11-segmented. Segment 1 twice as long as 2; 3 and 4 half as long and nearly ¾ as wide as 2; 5 wider than 4; 6 slightly narrower than 5; 7 about equal to 6; 8 narrower than 5; and 9 equal to 7. Segment 10 cup-shaped with 4

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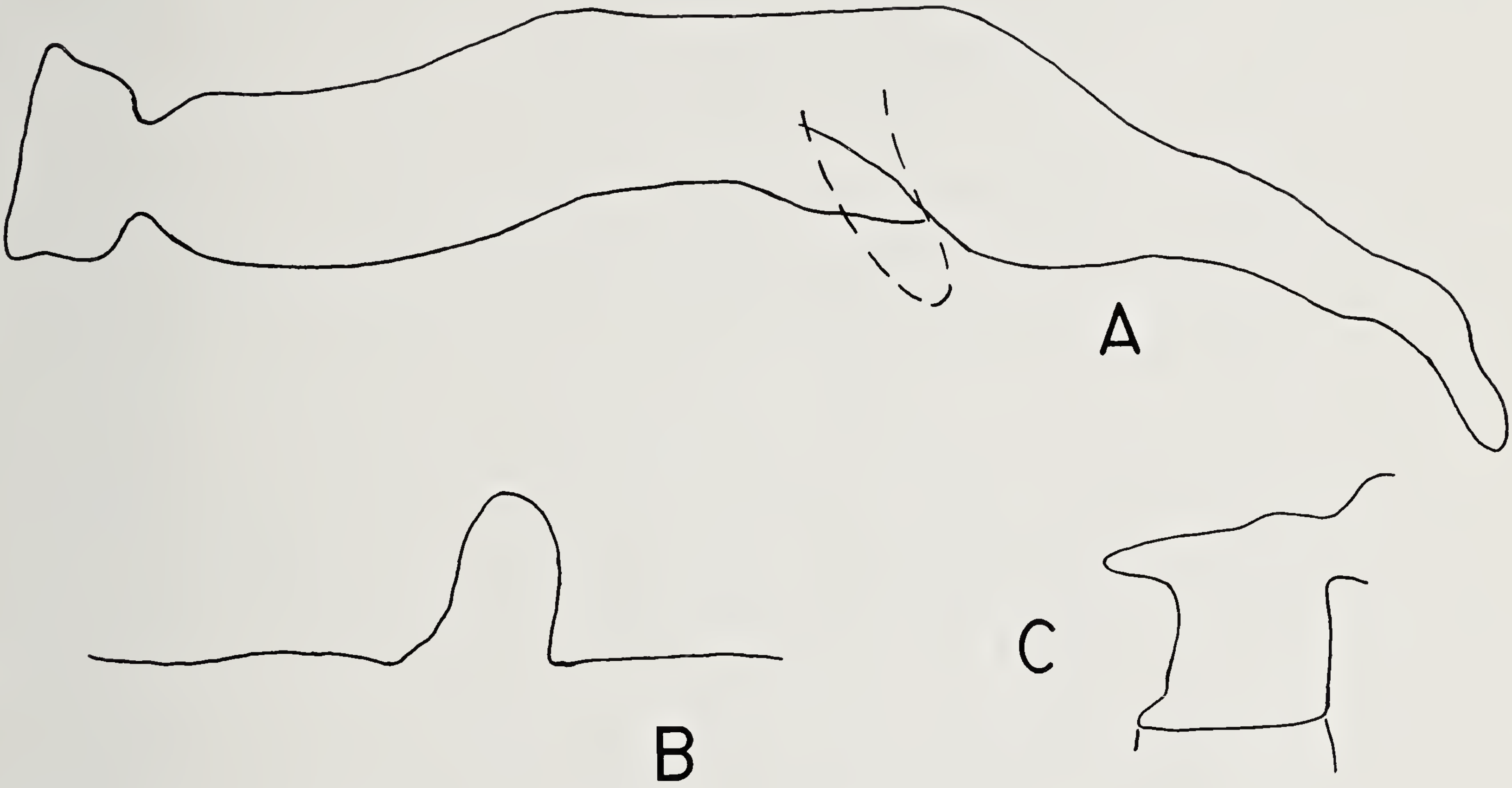
[1] This study was financed in part by the National Science Foundation (Grant GB-6284).

macrosetae; 11 equal to 10 in length with 7 lamellate setae evenly spaced around the base; these 2 segments form a club.

The thorax comprises about ⅓ the total length. Prothorax nearly square, being slightly longer than wide and narrower posteriorly. The meso- and metathorax equal in length to the prothorax. Apterous; elytra lacking fovea, disk simple, humeral angles rounded with apices truncate. Pro- and mesotrochanter simple and without spines; metarochanter of male spined, shaped as in Fig. C. Each tibia with a short comb of setae dorsally, a longer comb ventrally and 2 spines at the apex. Tarsi 2-segmented with a single claw.



Abdomen with 6 visible segments. Visible segments 5 and 6 not separated by an hexagonally marked membrane as are 1 through 5. Segments 1, 4 and 6 with doughnut-shaped spiracles. Sternite 6 of male notched, shaped as in Fig. B. Male genitalia shaped as in Fig. A.

Measurements in mu: Male, head length 185.0-201.0, width 133.0-144.3; pronotum length 128.7-140.0, width 85.6-124.8; elytra length 164.0-179.4, width 78.0; sternite 6 (across median line to distal end of notch) 62.4-85.6; notch 15.6-19.5; aedeagus length 179.4, width 15.6-23.4; total length 1147. Female, head length 201.0-218.0, width 133.0-156.0; pronotum length 133.0-14.0, width 133.0-140.0; elytra length 133.0-156.0, width 62.5-85.6; total length 1130-1150. Scale: 17.9 mus on drawing = .25 mu on the specimen.

Holotype: male, no. 13552, Northern California: Butte Co., about 1 mile east of Chico, Bidwell Park, ex Omicron plot, 8 December 1967, Coll. L. A. Royce, in soil 1 to 2 inches deep. In the Kistner Collection to be eventually deposited in the Field Museum of Natural History, Chicago.

Paratypes: 3 same data as holotype; 10, same locality as the holotype, 3 January 1969, Coll. L. A. Royce, (L. R., D. K.).

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Mayetia skeeteri: A, Aedeagus; B, Notched sternite 6 of male; C, Male metatrochanter. Scale equal to 0.25 mm.

An Upper Michigan Population Of *Cicindela Repanda* With Reduced Elytral Maculae (Coleoptera: Cicindelidae)

Robert C. Graves

Department of Biology
Bowling Green State University
Bowling Green, Ohio

On August 23, 1959 Anne Graves and I collected a series of 69 specimens of *Cicindela repanda* Dejean along the shore of Lake Superior at Grand Sable Sand Dunes, Alger County, Michigan. This population is interesting because of the large percentage of individuals with broken and greatly reduced elytral maculae.

The Grand Sable Dunes are one of the world's most impressive examples of shoreline sand dunes, rising abruptly some 700 feet from the narrow beach. The dunes are located from 3-7 miles west of the village of Grand Marais. The exact locality from which the 69 specimens were taken is known locally as the "Log Slide" about 6 miles due west of Grand Marais from which it was reached via primitive road. After parking the car at the "Log Slide" one slides down the face of the dune to the beach. We encountered difficulty in climbing back up an almost vertical wall of loose dry sand, which forms an effective barrier to the population of *C. repanda* below. This population occupies a narrow strip of moist sand beach only a few yards wide and is therefore partially isolated. There are several ravines cut into the face of the dune which provide shelter from high waves of Lake Superior. Small streams flow through these deep ravines, keeping the sand constantly moist; it is in these protected ravines that the larvae of *C. repanda* (and *C. hirticollis*) develop.

The population of *C. repanda* from Grand Sable Dunes was mentioned in Graves (1963) but has not been described previously. Of the 69 specimens, 51 (73.9%) have the elytral maculae not only narrowed but actually divided or "broken" including 15 (21.7%) in which the normal elytral pattern exists only as isolated spots (Fig.1).

In another member of the "*repanda* group", *C. duodecimguttata,* reduction of the elytral maculae into dots is normal, but in *C. repanda* it is rare. Vaurie (1951) described *C. repanda novascotiae* from Nova Scotia, Prince Edward Island, and the Magdalen Islands; in this population a high percentage of individuals have narrowed, broken or obliterated elytral maculae, only 24% resembling *C. repanda repanda* in their complete markings. In Newfoundland the population is rather typical and cannot be referred to *novascotiae* (Lindroth, 1955).

In the northern Great Lakes area, surrounding populations of *C. repanda* show varying degrees of macular reduction. Specimens from Sibley Provincial

Park, Ont. (9), Black River Park, Gogebic Co., Mich. (24), Waugoshance Point, Emmet Co., Mich. (28), and others contain occasional individuals with maculae narrowed and even broken but not reduced to dots. Those from Superior, Wis. are strongly maculated.

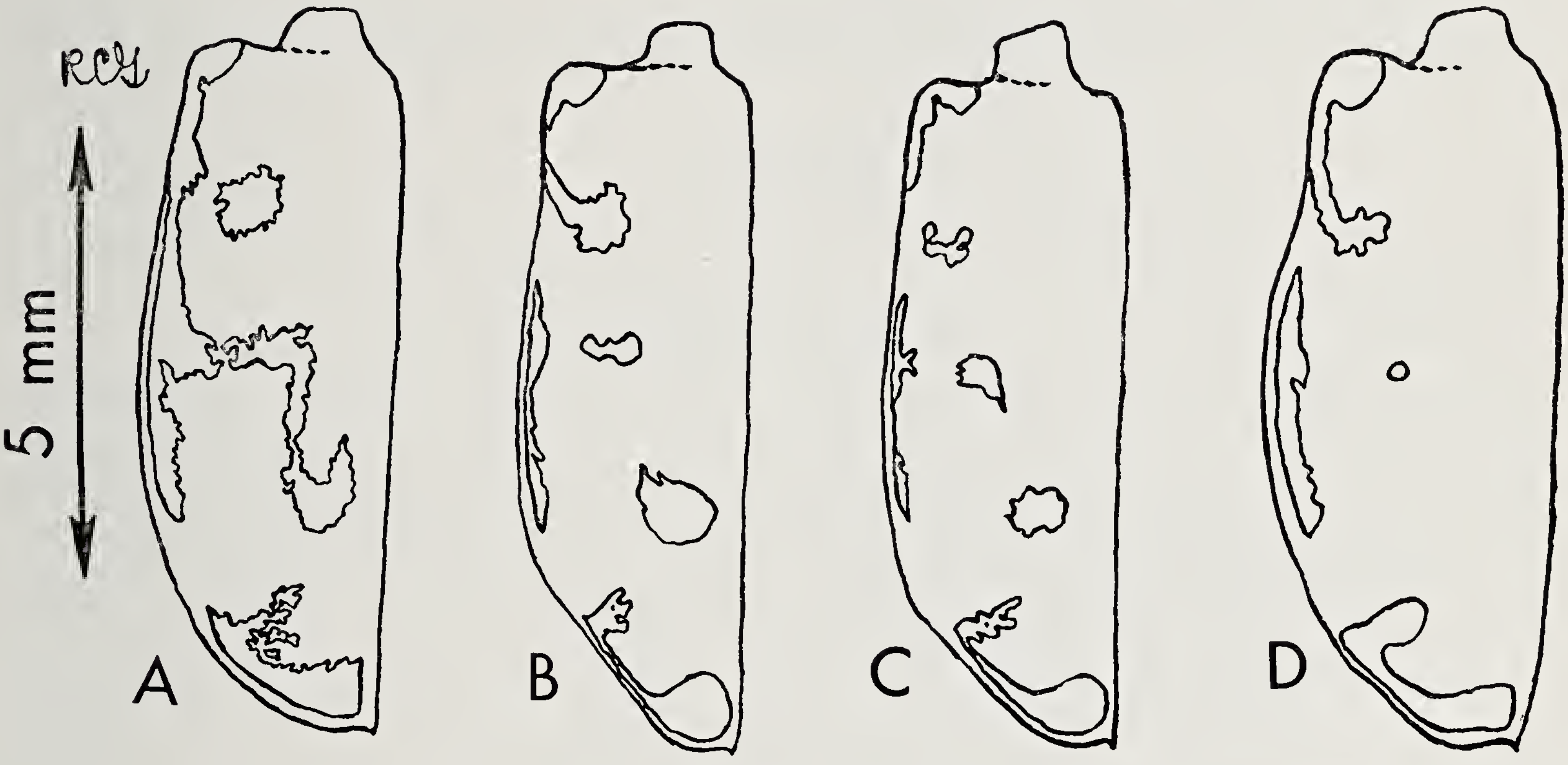

FIGURE 1. Left elytra of *Cicindela repanda* from Grand Sable Dunes, Alger County, Michigan: A. male with nearly normal *C. repanda* pattern but showing "erosion" of white markings; B. and C. two males showing markings reduced to widely separated spots; D. female with complete absence of the middle band.

The whole problem of intra-specific variation in *Cicindela* is exceedingly complex. It cannot be adequately explained simply as a consequence of climatic conditions (Shelford, 1917) as the various Lake Superior and Maritime populations are subject to similar environments, and yet show pronounced differences in macular variation within relatively short distances (*i. e.,* along the shore of Lake Superior). In some species, this might be explained as due to isolation as "demes". This may be true to some extent in *C. repanda* yet it is one of the most widespread and ubiquitous of North American *Cicindela* species and as such there should be sufficient "gene flow" to prevent population variations of this sort. The answer depends upon further study of *C. repanda* populations throughout the entire distribution of this species.

It is interesting to note that in the closely related species, *C. hirticollis,* elytral maculae are also greatly reduced in the northern Great Lakes area. *C. hirticollis* is presently under study by the author throughout its distribution. Similar study is needed on *C. repanda.* It is obvious that the same genes are operating in *C. repanda, C. hirticollis* and *C. duodecimguttata* with regard to macular variations but intra-specific variation in these three species provides problems, the answers for which depend upon more complete study of large series from many localities.

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REVIEWS

WORLD CROP PRODUCTION. Volume I: *PESTS AND DISEASES*. By J. H. SHAPLEY and F. C. H. GAYNOR. Cleveland: Chemical Rubber Company Press, 1969, 270 pp. Cloth $18.50.

This book provides the first single volume survey of the principle pests and diseases of the main cultivated crops in the world today. Wheat, barley, oats, rice, corn, sorghum, potatoes, sugar beets, cotton, sugar cane, tobacco, apples, pears, peaches, citrus fruits, grapes, olives, coffee, cocoa, tea, bananas, rubber, coconuts, and palm oil are considered individually. An introductory statement of importance, followed by descriptions (not diagnostic) of pests and diseases, their life history, distribution, damaged caused, selected methods of control, and a few illustrations form the bulk of the book. References are given at the end of each crop described. The final chapter deals with herbicidal weed control.

The plan is good, but, because of its wide scope, its weakness is its brevity. The description of pests and diseases requires for identification constant reference to other books and articles, only a few of which are listed. The methods of control considered are those most widely used on a world-wide basis, not necessarily the most up-to-date. Likewise, this means constant reference to other works since the most recent references given were published in 1965.

Thirty-three genera (including 7 'genus spp.' groups and 2 genus only) and 34 species of Coleoptera are mentioned. Of these, 14 species, 4 'genus spp.' groups, and 1 group (white grubs), are discussed in some detail including the mention of controls.

This readable account will be of general interest to the economic entomologist and plant pathologist, but not particularly to the coleopterist.—ERIC H. SMITH, Purdue University.

WORLD CROP PRODUCTION. Volume II: By K. A. HASSALL *PESTICIDES*. CRC. Press, 1969, 249 pp. Cloth $16.60.

This book provides basic information about pesticides and, by considering in detail a few of the more important chemicals in use, illustrates the fundamental principles underlying crop protection. Discussions include methods of application, routes by which the toxicant reaches the site of action, the barriers it encounters, and the functions of supplementary chemicals. The nature of toxic hazzards is explained and methods for minimizing toxic effects are discussed. Biochemical mechanisms are included and the various aspects of selective action are considered. The organochlorine and organophosphorus insecticides are comprehensively covered, and the properties of spray supplements and of organic and inorganic fungicides are discussed in detail. Natural insecticides, synthetic carbamate insecticides, organic acaricides, and herbicides are discussed in less detail.

The author does a commendable job in accomplishing his purpose. A very readable account of much detailed information on the nature of toxicants and how toxicants get their job done is presented.

Students, teachers, and the educated layman alike will find this a valuable guide with the proper perspective on the confusing and conflicting information published on this subject.—ERIC H. SMITH, Purdue University.

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4. Introduction to the Study of Beetles. By R. H. Arnett, Jr., Institute for the Study of Natural Species, 550 Elston Road, Lafayette, Indiana 47905. $1.00 postpaid.
5. Entomological News. Edited by R. H. Arnett, Jr., American Entomological Society, 1900 Race Street, Philadelphia, Pa. 19103. $7.00 per yr., individuals, $12.00, institutions.
6. Original Descriptions. CSC, Department of Entomology, Purdue University, Lafayette, Indiana 47907. $.10 per sheet, $.25 service charge per order.
7. Directory of Coleoptera Collections of North America. Edited by R. H. Arnett and G. A. Samuelson. CSC, Department of Entomology, Purdue University, Lafayette, Indiana 47907. $3.95 postpaid.
8. Photographic prints, copies from data files, reprints of journal articles, by inquiry to CSC, Department of Entomology, Purdue University, Lafayette, Indiana 47907.
9. Studies on Speciation No. 1: The taxonomy and speciation of Pseudophonus. Institute for study of Natural Species, 550 Elston Road, Lafayette, Indiana 47905. $3.95.

Notices

CANTHARIDAE: Carrying on revisional studies in this family and in *Ellychnia* of the Lampyridae. K. M. Fender, 911 Ashwood Ave., McMinnville, Ore. 97128.

TENEBRIONIDAE: Studying the cave-dwelling forms of the Western Hemisphere, T. J. Spilman, U. S. Nat. Museum, Washington, D. C. 20560.

CHRYSOMELIDAE: Revising Alticinae of Oceania; wish to borrow material from Fiji Is., New Caledonia, New Hebrides, New Zealand, etc. G. A. Samuelson, Department of Entomology, Purdue University, Lafayette, Indiana 47907.

OEDEMERIDAE: Preserved in alcohol (preferred) or pinned desired for revision of family for World. R. H. Arnett, Jr., Department of Entomology, Purdue Univ., Lafayette, Ind. 47907.

EUROPEAN BEETLES: Wish to exchange with collectors in the USA; special interest in Curculionidae. Dr. Gert Engelmann, Garnisongasse 3/16, A-1090 Wien, Austria.

SCARABAEIDAE, LUCANIDAE: Wish to exchange or purchase specimens from any place in the world. John D. Glaser, 924 North Hill Road, Baltimore, Maryland 21218.

ANOBIIDAE: Assembling world-wide collection. Now studying Papuan Sub-Region species. Will exchange for Coleoptera (all families) from E. United States. E. J. Ford, Jr., Rm. 506, 123 S. Gay St., Baltimore, Md. 21202.

CHRYSOMELIDAE: Revising *Systena* (Alticinae) of America north of Mexico; wish to borrow material. Eric H. Smith, Dept. of Entomology, Purdue University, Lafayette, Indiana 47907.

TENEBRIONIDAE: Revising tribe Asidini. Would like to borrow material. Especially interested in associated immatures, and biological observations. Kirby W. Brown, Dept. of Entomology, Univ. of Calif., Riverside, Calif. 92502.

CARABIDAE: Will exchange French beetles of families Scarabaeidae, Histeridae, Buprestidae, Chrysomelidae, Coccinellidae, Anthicidae, Tenebrionidae, and water beetles for U. S. Carabids. Jacques Negre, 9, Bd. De Lesseps, Versailles, France.

SCARABAEIDAE: Interested in obtaining specimens of the genus *Coenonycha* for research and in building up a collection of scarab genera from the U.S.A. Exchange. Mrs. Jean Davidson, Dept. of Entomology, Oregon State University, Corvallis, Ore. 97331.

BUPRESTIDAE: Will exchange specimens and determine *Chrysobothris* from southwestern U.S.A. Jerry Davidson, Dept. of Entomology, Oregon State University, Corvallis, Oregon 97331.

CARABIDAE, SCARABAEIDAE: Collect, exchange. William D. Harding, 4365 Midland, Drayton Plains, Mich. 48020.

SCARABAEIDAE: Limited number of *Pleocoma badia* available. Terry W. Taylor, 8529 Norwood Pl., Rosemead, CA 91770.

ELATERIDAE: Revising *Physorhinus*, wish to borrow pinned or alcohol material. D. Schaaf, Dept. of Entomology, Purdue University, Lafayette, Indiana 47907.

STAPHYLINIDAE: Currently beginning study of taxonomy and morphology of larvae and adults of the Staphylinid subfamily Leptotyphlinae. Would like to borrow specimens in this group from North America primarily, but would welcome material from Central or South America. J. F. Cornell, Ass't Prof. of Biology, Appalachian State University, Boone, N. Car. 28607.

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By Ross H. Arnett, Jr.

Proffessor of Entomology at Purdue University

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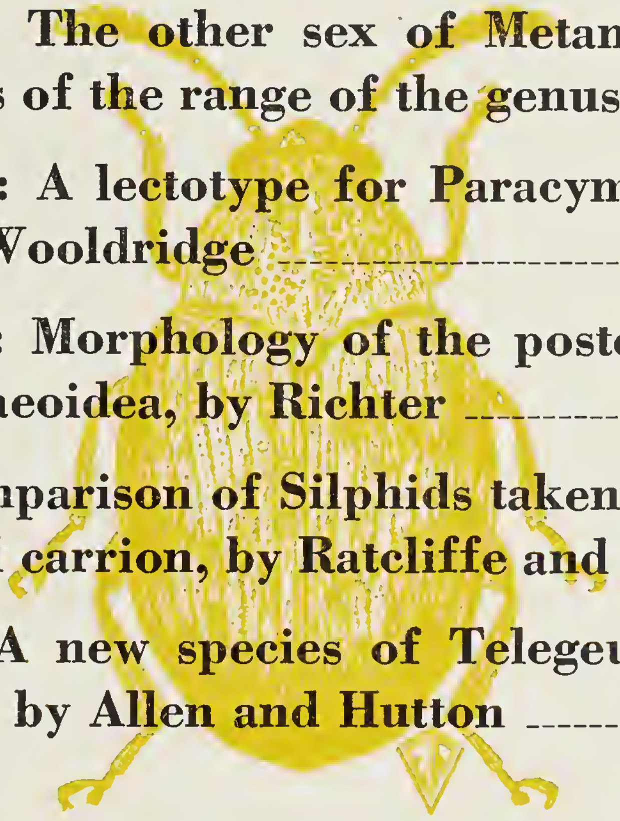

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Founded 1947 by Ross H. Arnett, Jr.

The Coleopterists' Bulletin is published by the Department of Entomology, Purdue University, Lafayette, Indiana 47907 as a part of the projects of CSC, (Center for the Study of Coleoptera) and is edited by Dr. N. M. Downie. It is issued four times a year beginning with March. All business matters as well as editorial matters and manuscripts may be sent to the above address.

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This journal is published as a part of the project at Purdue University known as "CSC"—Center for the Study of Coleoptera. Other publications are available (see back cover).

THE COLEOPTERISTS' BULLETIN

VOLUME 23 DECEMBER 1969 NUMBER 4

Morphology of the Posterior Procoxal Bridges in Scarabaeoidea (Coleoptera)[1]

PAUL O. RITCHER

OREGON STATE UNIVERSITY, CORVALLIS

The prothoracic coxal cavities of adult Coleoptera may be either entire (=closed) or open behind. If entire, the procoxal cavities are closed posteriorly by the meeting of the epimera with the prosternum or by the meeting of the epimera on the midline. If open, the space behind the procoxae is bridged over in whole or in part by membrane (Imms, 1964), Both open and closed procoxal cavities are found in the Adephaga and even within the same tribe in the Carabidae (Bell, 1967). In the Haliplidae and Gyrinidae, however, only 1 type was found.

Arnett (1968), in his manual for identification of beetles of the United States, states that having open or closed procoxal cavities may be used for distinguishing families, subfamilies, and tribes. Included in most family descriptions is a statement regarding this character. Examination of his descriptions indicates that more beetle families have the procoxal cavities open behind than have them closed. Both open and closed procoxal cavities are said to occur in Ostomidae, Cleridae, Nitidulidae, Cucujidae, Coccinellidae, Lathridiidae and Colydiidae.

Little mention concerning the closure of the procoxal cavities of Scarabaeoidea can be found in the literature. Hayes (1922) figured the ventral surface of the prothorax of *Phyllophaga crassissima* Blanch showing closed coxal cavities but stated incorrectly that the coxal cavities were partly open. Mohr (1930), in comparing the external morphology of *Canthon, Aphodius* and *Bolbocerosoma,* described and figured the ways in which the tips of their epimera fit into sockets in the sternellum to form a postcoxal bridge.

Butt (1944) indicates that the procoxal cavities are closed posteriorly in the scarabaeid *Amphimallon majalis* (Razoum). Arnett (1968) states that the procoxal cavities are closed posteriorly in all Lucanidae, Passalidae and Scarabaeidae.

DESCRIPTION OF POSTERIOR PROCOXAL BRIDGES OF SCARABEOIDEA

The following descriptions are based upon an examination of adults of more than 150 genera made during a study of the spiracles (Ritcher, 1969a and b). Included were adults of many genera of Lucanidae and Passalidae and adults of over 100 genera representing 19 subfamilies of Scarabaeidae. The morphology of the components of the posterior procoxal bridge was studied in detail for 40 genera.

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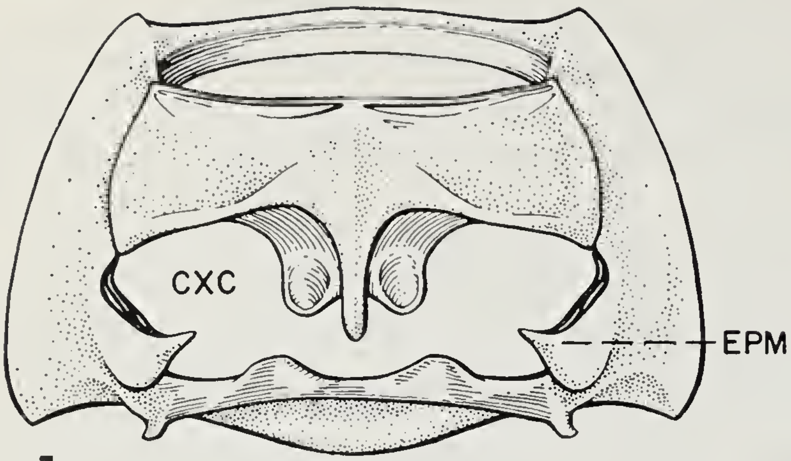
[1] Technical Paper no. 2679, Oregon Agricultural Experiment Station. This investigation was supported in part by grant GB-6194X from the National Science Foundation.



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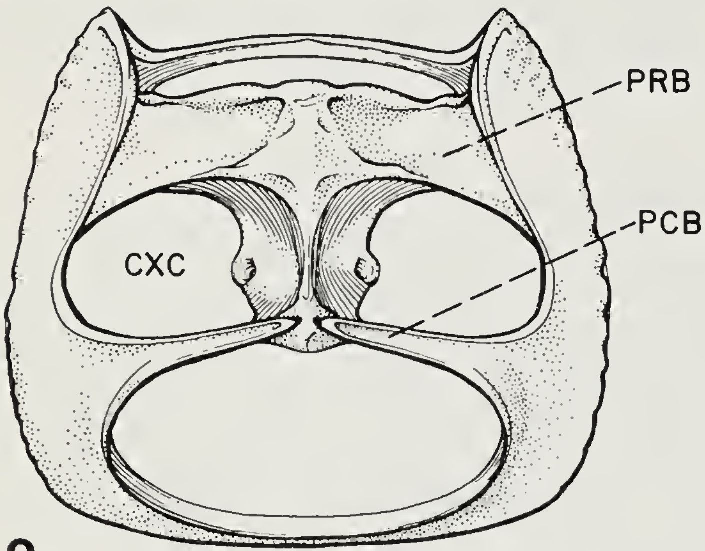

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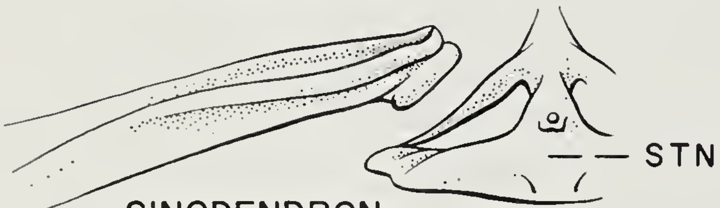

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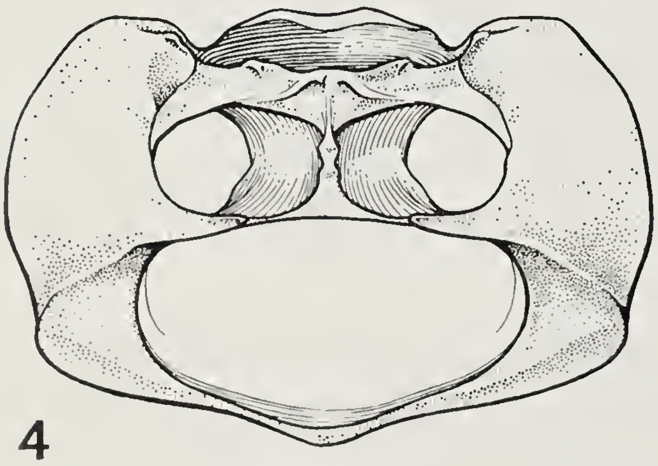
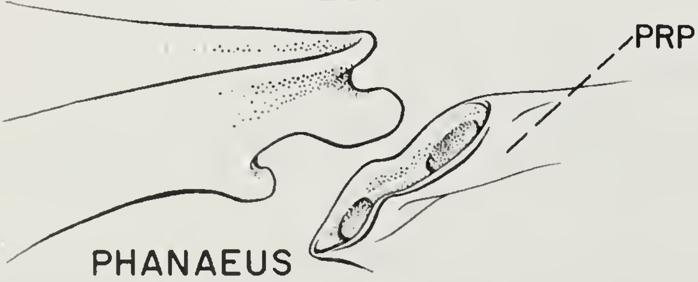


4 PHANAEUS



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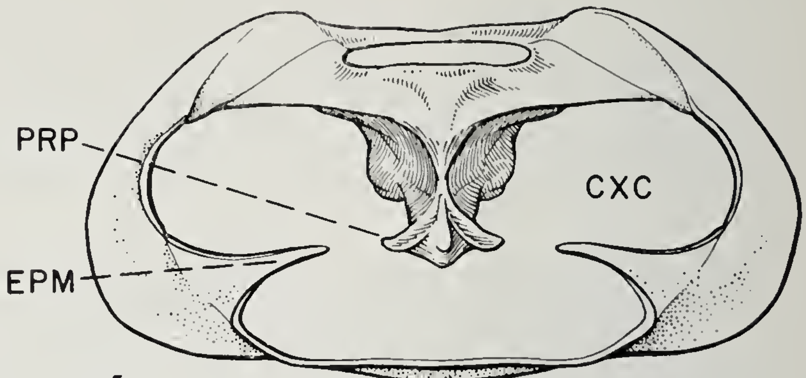
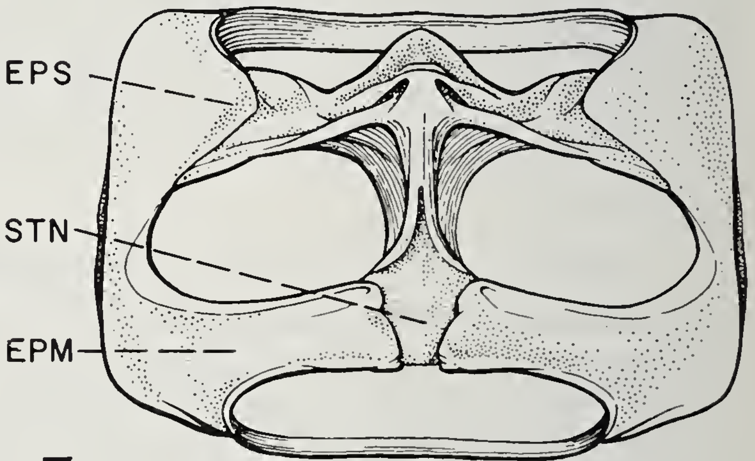
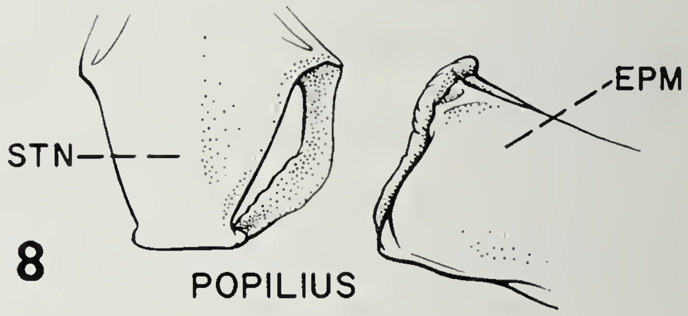


6 PLEOCOMA



7 POPILIUS



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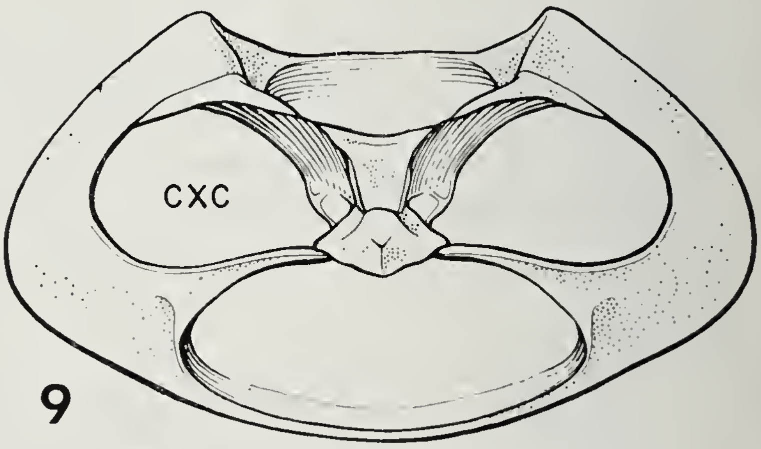
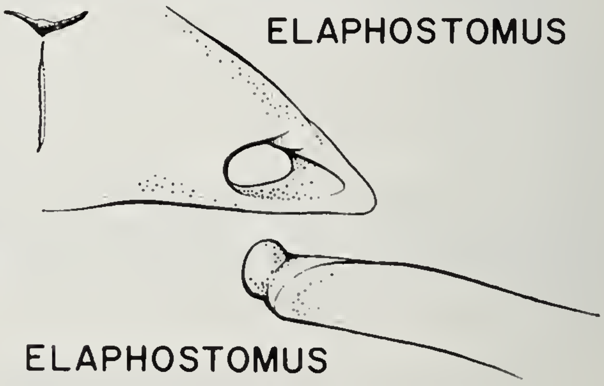


9 ELAPHOSTOMUS



10 ELAPHOSTOMUS

Passalidae. Procoxal cavities closed by postcoxal bridges (Fig. 7). Proepimeron broadly joined to sternellum. Proepimeron with truncate apex slightly expanded into a rather flat, subtriangular stud which fits tightly into a subtriangular socket on the lateral surface of the sternellum (Fig. 8).

Lucanidae. Procoxal cavities closed by postcoxal bridges (Fig. 2). Epimeron with stud-like apex (Fig. 3) or with recurved apex which fits tightly into a corresponding socket in the lateral surface of the sternellum. Type of connection between apex of epimeron and the sternellum similar to that of many Scarabaidae.

Scarabaeidae. Procoxal cavities closed by postcoxal bridges (except in Pleocoma). Epimeron tapering toward apex (Figures 4 and 9); apex with an inwardly projecting stud (or studs) or a recurved process which fits into a socket in the lateral surface of the sternellum (Figures 5 and 10). Ventral stud often ball-like, wedge-like, or elliptical; usually with grooves on one, both, or all sides. Tip of epimeron tightly held in socket in most genera; tip of epimeron loosely held in the sternal socket in some groups such as some Geotrupinae (*Elephostomus*), Hybosorinae (*Hybosorus*), Chironinae (*Chiron*), Melolonthinae (*Diplotaxis*), and Rutelinae (*Anomala*).

Scarabaeinae. Procoxal cavities closed by postcoxal bridges (Figure 4). Epimeron short, sternellum with poststernal processes. Epimeron usually with 2 flattened, subapical studs which fit tightly into a double socket in the lateral surface of the apex of poststernal process (Figures 4 and 5). Only the anterior stud present in *Oniticellus* and a single socket in poststernal process.

Pleocominae (*Pleocoma*). Procoxal cavities open behind (Figure 6). Epimeron a long tapering sclerite, extending more than half way across the postcoxal area. Prosternum with short poststernal processes.

DISCUSSION AND CONCLUSIONS

The structure of the posterior procoxal bridges of adult Passalidae is distinctly different from that of Lucanidae and Scarabaeidae. This, plus the unique characters of their larvae such as the orthosomatic body, the reduced segmentation of the antenna and maxillary palpus, the reduction of the hind leg to a stridulatory organ and the arrangement of the spiracles (Ritcher, 1966), suggests that the Passalidae may have arisen from an earlier offshoot of the ancestral scarabaeiform stock, not as a direct offshoot of Lucanidae as suggested by Crowson (1955 and 1960).

FIGURES 1, 2, 4, 6, 7, and 9. Ventral views of prothorax with legs removed. Figures 3, 5, 8, and 10. Caudoventral views of apex of epimeron and socket of the sternellum into which each fits. Figure 1. *Dascillus* sp. (Dascillidae). Figures 2 and 3. *Sinodendron rugosum* Mann. (Lucanidae). Figures 4 and 5. *Phanaeus igneus floridanus* MacL., (Scarabaeidae: Scarabaeinae). Figure 6. *Pleocoma dubitalis* Davis (Scarabaeidae: Scarabaeinae). Figures 7 and 8. *Popilius disjunctus* Illiger (Passalidae). Figures 9 and 11. *Elaphostomus probosideus* (Schreiber, (Scarabaeidae: Geotrupinae). CXC, coxal cavity; EPM, epimeron; EPS, episternum; PCB, postcoxal bridge; PRCB, precoxal bridge; PRP, poststernal process; STN, sternellum. Drawings by Bonnie Hall.

The true origin of the epimeron as a pleural element is indicated in the posterior procoxal bridges of Scarabaeoidea by the lack of any fusion of the epimeron with the prosternum. Instead, the apex of epimeron is held in a socket in the sternellum by a stud or studs or a recurved process. In some instances (Figure 10) the mechanism resembles a snap fastener used on clothing and the stud can be removed or replaced in the socket with a minimum of pressure.

Beetles of the genus *Pleocoma,* unlike, all other Scarabaeoidea, have procoxal cavities which are open posteriorly (Figure 6). This indicates that *Pleocoma* is probably the least specialized genus of the Scarabaeoidea. Other evidence of plesiomorphism in *Pleocoma* is found in the structure, number and location of the spiracles of the adults (Ritcher, 1969 a and b); in the large number of ovarian tubules in the female; and in the presence of 9 or more larval instars instead of the usual 3 (Ellertson and Ritcher, 1959).

The procoxal cavities of several genera of Dascillidae (*Araeopidus, Dascillus* and *Macropogon)* were examined since Crowson (1960) has suggested that the ancestral Scarabaeiformia (and Elateriformia) may have developed from a dascillid-like ancestor. All 3 genera have the procoxal cavities open behind as reported by Arnett (1968) for the family. In *Dascillus,* whose larva has some scarabaeoid features (Boving, 1929 and Boving and Craighead, 1931), the proepimeron extends part way across the posterior part of the coxal cavity (Figure 1).

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A New Genus and Two New Species of Sticholotini (Coleoptera: Coccinellidae) from South America

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SYSTEMATIC ENTOMOLOGY LABORATORY, ENTOMOLOGY RESEARCH DIVISION,
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The new genus described herein falls in the Sticholotinae as defined by Sasaji (1968). The narrow terminal segment of the maxillary palpus, widely spaced mesocoxae, cryptotetramerous tarsi, and elongate triangular female genital plates place it in this subfamily. *Nexophallus,* new genus, belongs in the tribe Sticholotini and is most nearly related to the Old World genus *Sticholotis* Crotch. *Sticholotis* has 11-segmented antennae, incomplete postcoxal lines, and always symmetrical male genitalia. *Nexophallus* has 10-segmented antennae, complete postcoxal lines, and symmetrical or asymmetrical male genitalia. In Pope's (1962) key to the genera of the Pharini (Sticholotini), *Nexophallus* goes to couplet 2, *Plotina* Lewis, from Japan, which has 11-segmented antennae.

Other Western Hemisphere genera thus far recognized as belonging to the Sticholotinae have a different habitus and perhaps should be placed in a tribe other than the Sticholotini. These genera, such as *Microweisea* Cockerell and *Coccidophilus* Bréthes, are characterized by their minute size, elongate-oval form, clypeus elongate in front of eyes and emarginate laterally for antennal insertion, and postcoxal line in two parts, one extending nearly to lateral margin of first abdominal sternum along anterior margin, the other extending downward nearly to hind margin of first abdominal sternum, then outward toward lateral margin. *Sticholotis, Nexophallus* and related genera are usually larger, very round and convex, clypeus not or very slightly elongate in front of eyes and not always emarginate laterally for antennal insertion, and postcoxal line single, complete or incomplete.

Thanks must go to Hugh Leech, California Academy of Sciences for the loan of the type series of *Nexophallus semiglobus,* n. sp.

Nexophallus, new genus

Body round, extremely convex; dorsum faintly pubescent. Head broad, clypeus short, anterior margin trunate; eye small, situated on lateral margin of head; antenna inserted under anterior angle of clypeus immediately anterior to eye, 10-segmented, club 3-segmented, apical segment largest (fig. 4); labrum short, narrower than clypeus; maxillary palpus nearly as long as antenna, terminal segment strongly narrowing apically; mandible bidentate at apex, a small tooth at basal angle (fig. 7); Labial palpus ventrally articulated, terminal segment narrowing apically, basal segment very small (fig. 5). Pronotum deeply emarginate anteriorly, anterior angles produced, rounded. Scutellum small, triangular. Elytron with lateral margin sinuate, distinctly margined; elytral epipleura slightly descending externally, broad basally, narrowing toward apex, not reaching apex of elytron, not foveate for reception of femora. Underside of body nearly flat, not foveate for reception of any femora. Prosternum with

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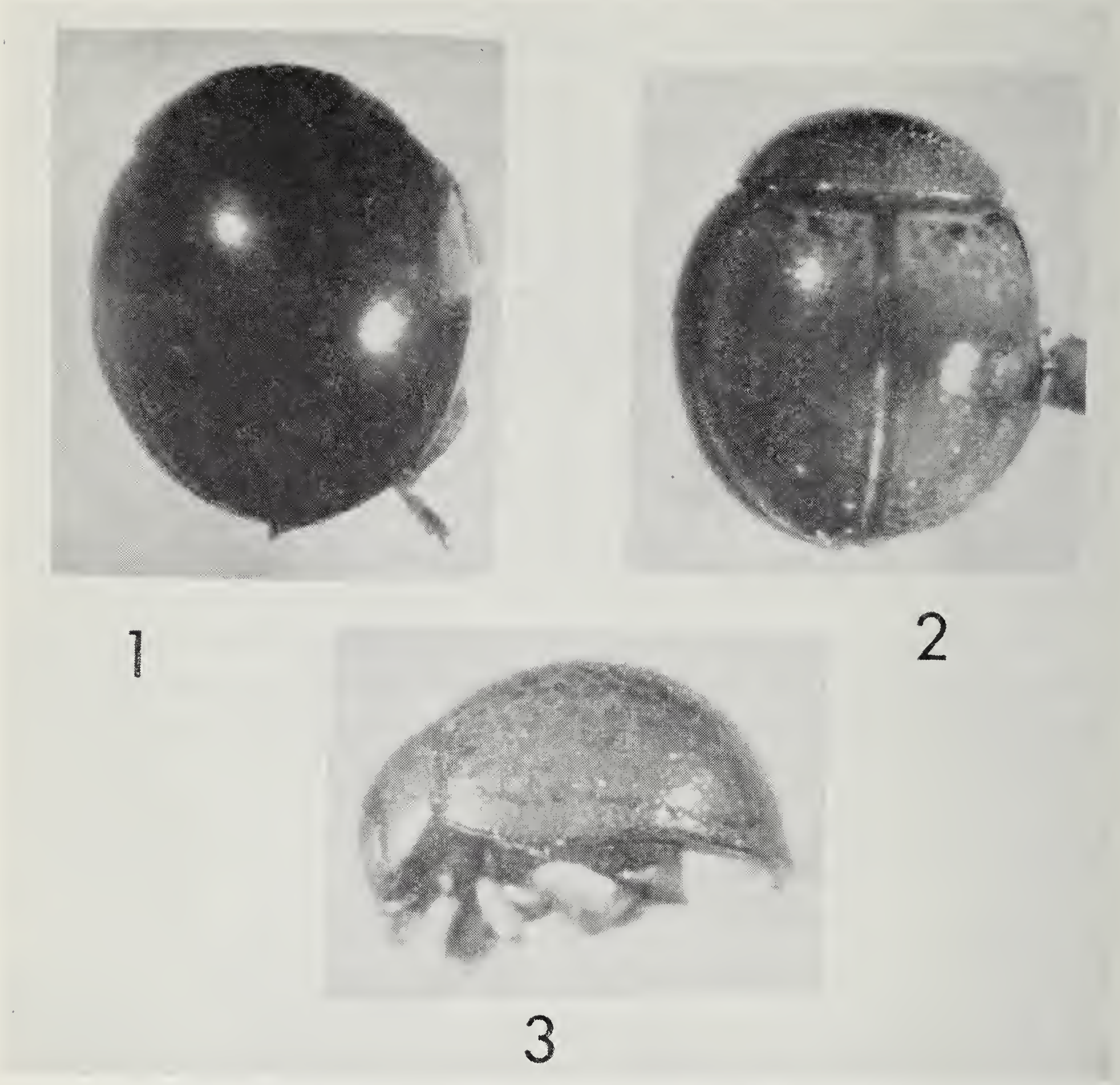
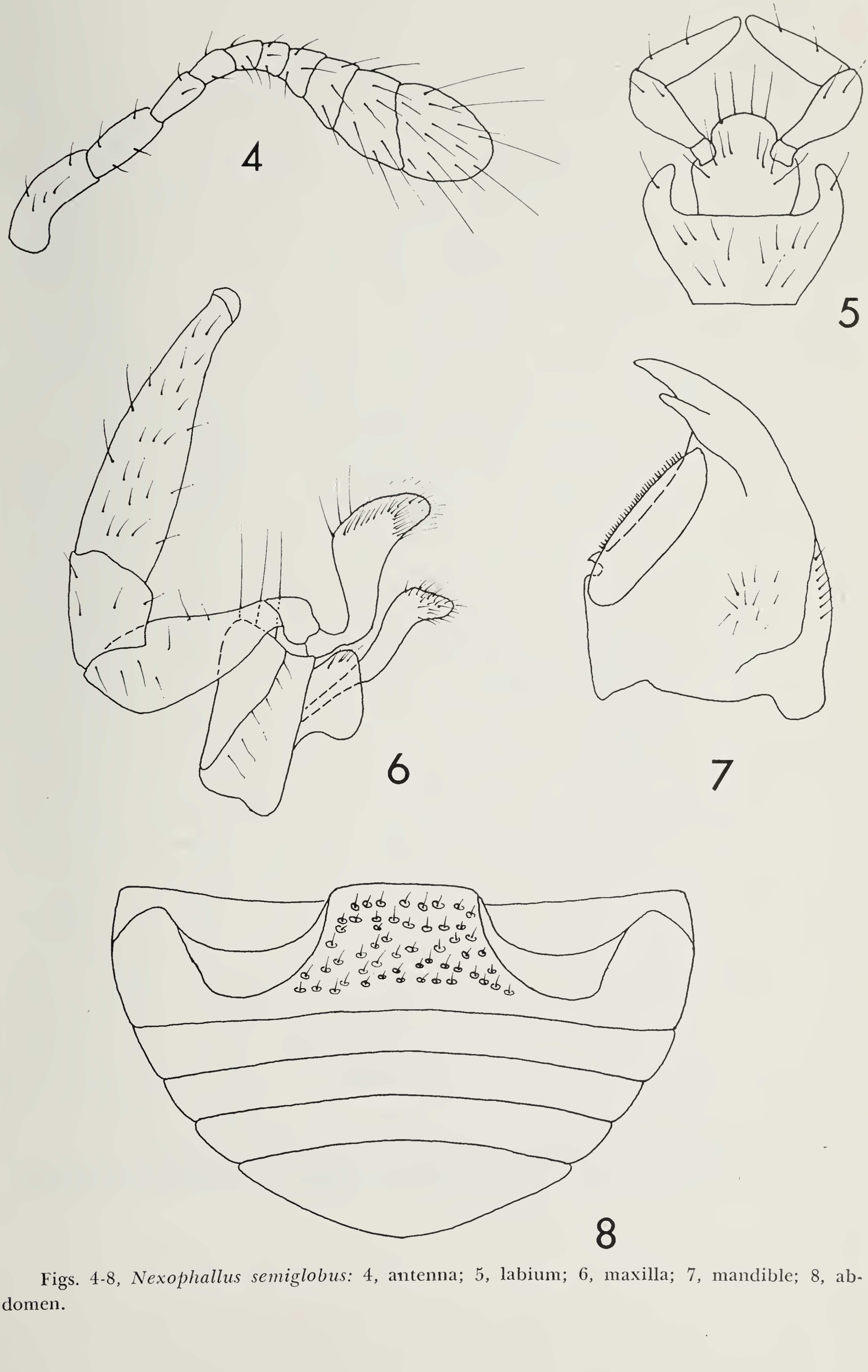


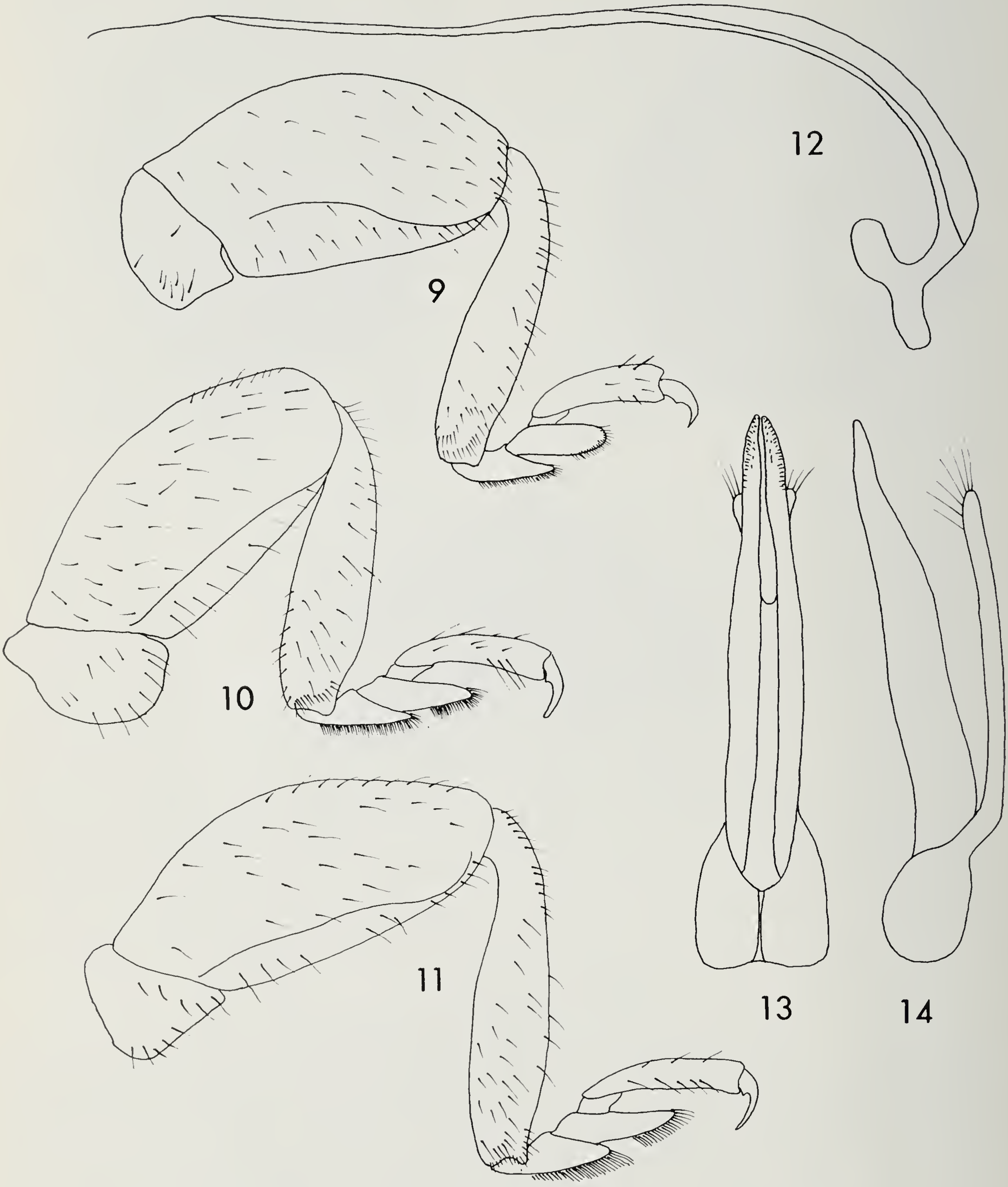
Fig. 1, *Nexophallus semiglobus,* dorsal view. Fig. 2, *Nexophallus rufoglobus,* dorsal view. Fig. 3, *Nexophallus rufoglobus,* lateral view.

a small anterior lobe, posterior projection rectangular, widely separating the procoxae. Mesosternum broadly articulated with metasternum, mesocoxae widely separated, anterior margin slightly concave. Legs long, apex of femur extending beyond outer margin of body, all femora swollen and grooved for reception of tibiae; all tibiae thickened medially; tarsus cryptotetramerous, a very small segment present between the second and terminal segments; tarsal claws weakly toothed basally (figs. 9, 10, 11). Abdomen with 5 visible sterna; first sternum with complete postcoxal lines (fig. 8). Female genitalia with genital plates elongate triangular with a stylus present (fig. 18). Male genitalia with parameres shorter than basal lobe, strongly sclerotized, symmetrical or asymmetrical.

Type species, *Nexophallus semiglobus,* n. sp.

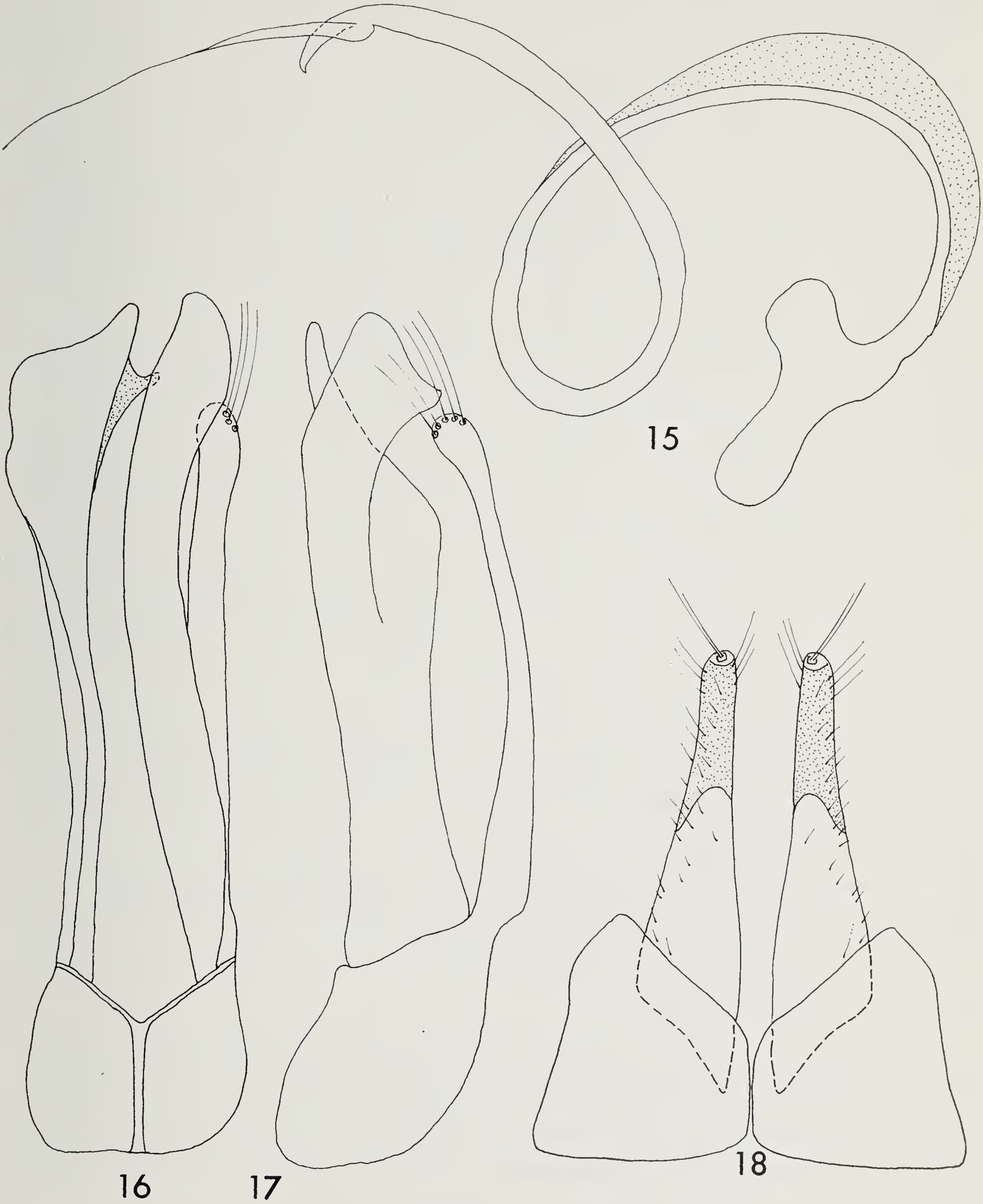


Figs. 4-8, *Nexophallus semiglobus:* 4, antenna; 5, labium; 6, maxilla; 7, mandible; 8, abdomen.



Figs. 9-11, *Nexophallus semiglobus:* 9, front leg; 10, middle leg; 11, hind leg.

Figs. 12-14, *Nexophallus rufoglobus,* ♂ genitalia: 12, sipho; 13, 14, phallobase, ventral and lateral views.



Figs. 15-18, *Nexophallus semiglobus,* genitalia: 15, sipho; 16, 17, phallobase, ventral and lateral views; 18, ♀ genital plates.

KEY TO SPECIES OF NEXOPHALLUS

Dorsal surface black; median area of first abdominal sternum with large setigerous punctures	**semiglobus**, n. sp.
Dorsal surface rufous; median area of fist abdominal sternum with very fine setigerous punctures	**rufoglobus**, n. sp.

Nexophallus semiglobus, n. sp.

(Figs. 1, 4, 5, 6, 7, 8, 9, 10, 11, 15, 16, 17, 18)

Holotype male.—Length 2.00 mm., width 1.80 mm. Form strongly convex, head not visible in dorsal view (fig. 1). Dorsal surface with sparse pubescence; head and pronotum with pubescence white, short, appressed; elytral pubescence yellow, long, erect. Dorsal surface entirely black, labrum and antenna yellowish brown; underside reddish brown, legs slightly darker. Head shining, faintly alutaceous, densely punctured, punctures separated by one or two times their diameter; eyes small, widely spaced, separated by four times the width of an eye. Pronotum shining, faintly alutaceous, densely punctured, punctures equal to head punctures and separated by one or two times their diameter. Elytra shining, not alutaceous, not densely punctured, large and small punctures present, separated by two or three times the diameter of a large puncture; epipleura with an internal carina above the inner margin. Underside of head with coarse reticulate punctures; antenna short, extending to basal angle of pronotum, inserted dorso-laterally between anterior margin of eye and mandible; maxillary palpus long, terminal segment longer than two previous segments (fig. 6). Prementum narrow posteriorly, mentum deeply emarginate anteriorly, narrowing posteriorly (fig. 5). Prosternum with intercoxal process and anterior lobe with very large, deep reticulate punctures, a short seta rising from the center of each puncture, two widely divergent carinae present laterally, posterior broadly margined. Mesosternum with intercoxal area strongly margined anteriorly, an uneven row of coarse setigerous punctures across the intercoxal area. Metasternum with coarse setigerous punctures scattered throughout, postcoxal line reaching lateral margin. Legs with setae scattered throughout (figs. 9, 10, 11). Abdomen with postcoxal lines complete, reaching two-thirds the distance to hind margin of first sternum, abruptly curving upward to anterolateral margin, median area of first sternum with large setigerous punctures (fig. 8). Genitalia with parameres slightly shorter than basal lobe, sides sinuate, left paramere slightly shorter than right paramere; basal lobe split from median point to apex, in ventral view the right half curved with apex rectangular, the left half curved with inner anterior corner of apex ending in a blunt projection, left half with a membranous lobe on inner margin near apex and a strong angulate projection dorsally on outer margin (figs. 16, 17); sipho long, a wide membranous area present from near base to near median point, apex sharp, curved downward, a long attenuate apical process rising laterally near apex (fig. 15).

Female.—Similar to male. Genital plates long, triangular, dark colored in apical third, distinct stylus present at apex (fig. 18).

Variation.—Size is constant in type series, one paratype paler in color, slightly teneral.

Holotype.—Ecuador; 2.8 mi. N. of Puyo, Napo Pastaza, 953 m., II-9-1955, E. I. Schlinger & E. S. Ross collectors (California Academy of Sciences).

Paratypes.—Same data as holotype, 4 deposited in California Academy of Science Collection, 2 in USNM collection.

Nexophallus rufoglobus, n. sp.

(Figs. 2, 3, 12, 13, 14)

Holotype male.—Length 2.10 mm., width 1.90 mm. Form strongly convex, head not visible in dorsal view (figs. 2,3). Dorsal surface with sparse pubescence; head and pronotum with pubescence yellowish white, short, appressed; elytral pubescence yellow, long, erect.

Dorsal surface entirely rufous, labrum and antenna yellow; underside rufous, legs, maxilla and labium yellow. Head shining, faintly alutaceous, densely punctured, punctures separated by their diameter or less; eyes small, widely spaced, separated by slightly less than four times the width of an eye. Pronotum shining, faintly alutaceous, finely punctured, large and small punctures present, separated by two or three times the diameter of a large puncture. Underside of elytra coarsely reticulate, reticulation visible in dorsal view; epipleura with an internal carina above the inner margin. Underside of head with coarse reticulate punctures; antenna short, extending to basal angle of pronotum, inserted dorso-laterally between anterior margin of eye and mandible; maxillary palpus long, terminal segment longer than two previous segments. Prosternum with intercoxal process and anterior lobe with large, reticulate, setigerous punctures, two widely divergent carinae present laterally, posterior broadly margined. Mesosternum with intercoxal area strongly margined anteriorly, coarse setigerous punctures scattered across intercoxal area. Metasternum with coarse setigerous punctures scattered throughout, postcoxal lines reaching lateral margin. Legs with setae scattered throughout. Abdomen with postcoxal lines complete, reaching over one-half the distance to hind margin of first sternum, abruptly curving upward to antero-lateral margin, median area of first sternum with fine setigerous punctures scattered across median area. Genitalia with parameres shorter than basal lobe, sides sinuate, equal in length; basal lobe split in apical one-third, each half with sides sinuate, tapering to a blunt point (figs. 13,14); sipho short, a wide membranous area present from near base past median point, apex acuminate, straight (fig. 12).

Female.—Similar to male except genitalia. Genital plates long, triangular, dark colored in apical third, distinct stylus present at apex.

Holotype.—Bolivia; Rurrenabaque, Rio Beni, Oct., WM. Mann, Mulford Biol. Exp., 1921-1922 (USNM 70410).

Paratype.—Bolivia; Lower Rio Madidi, Feb., WM. Mann, Mulford Bio. Expl., 1921-22; 1, in USNM collection.

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Pachyonychis Clark and *Pachyonychus* Melsheimer: Nomenclatural Confusion

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There has been much confusion over the past 100 years with the generic names *Pachyonychis* Clark, *Pachyonychus* Melsheimer, *Hamletia* Crotch, and *Clarkaltica* Weise. This confusion has even extended to the authorship of *Pachyonychis* and *Pachyonychus*. This paper attempts to clarify this situation.

The generic name *Pachonychus* attributed to Chevrolat first appeared in the third edition of the Dejean Catalogue (1837), with the species *P. dimidiaticornis* Dejean listed under it. Neither the genus nor the species was described and thus both must be considered *nomina nuda*.

In 1847, Melsheimer described a species which he questionably assigned to *Pachyonychus* "Chevrolat". He named this species *P. paradoxus*. Although this species was questionably assigned to *Pachyonychus,* this nevertheless constitutes an indication and *Pachyonychus* should therefore be attributed to Melsheimer.

Clark (1860) described the genus *Pachyonychis* with reference to the Dejean Catalogue. He also named and described a species, *P. paradoxus,* again giving reference to the Dejean Catalogue and obviously intending this to be a replacement name for *P. dimidiaticornis* "Dejean". Because of Clark's mention of this species as being in the collection of Chevrolat, it is most likely that his conception of the genus *Pachyonychis* was much closer to that of Chevrolat than was that of *Pachyonychus* Melsheimer. Whether Clark's spelling of *Pachyonychis* represents a *lapsus calami* or not is uncertain. Therefore, we must consider *Pachyonychis* Clark and *P. paradoxus* Clark as new and valid taxa.

In 1873, Crotch gave a short description of *Pachyonychus* "Chevrolat" and placed the species, *P. paradoxus* Melsheimer, in this genus. Because Melsheimer's indication had not been recognized as such, Crotch was henceforth credited with *Pachyonychus.* He also gave a description of *Pachyonychis paradoxus* Clark, however, it was misspelled to read *Pachyonychus paradoxus.* Since both genera thus had the same name, Crotch proposed to use *Hamletia* as a replacement for *Pachyonychis* Clark and *H. dimidiaticornis* Crotch as a replacement for *P. paradoxus* Clark.

Weise (1921) showed the confusion then prevalent by proposing *Clarkaltica* as a replacement name for *Pachyonychus* Crotch. This name has since been treated as a junior synonym of *Pachyonychus* Crotch.

Since the time of Clark and Crotch, American authorities including Leng (1920) have considered *Hamletia* Crotch as the senior synonym of *Pachyonychis* Clark. European authorities including Heikertinger and Csiki (1940), however, have considered *Pachyonychis* Clark as the senior synonym of *Hamletia* Crotch. As can be seen above, *Pachyonychis* Clark is correctly the senior synonym of *Hamletia* Crotch. Both American and European authorities have incorrectly considered Crotch as the author of *Pachyonychus* instead of Melsheimer.

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A Lectotype for *Paracymus armatus* (Sharp) (Coleoptera: Hydrophilidae)

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During a study of the species of *Paracymus* of Central America and Mexico it became necessary to fix the identity of *Paracymus armatus* (Sharp) because of some confusion in the literature concerning this species. The original description includes the information that the apices of the elytra are broadly yellow, but it does not indicate whether the yellow margin is sharply or diffusely defined.

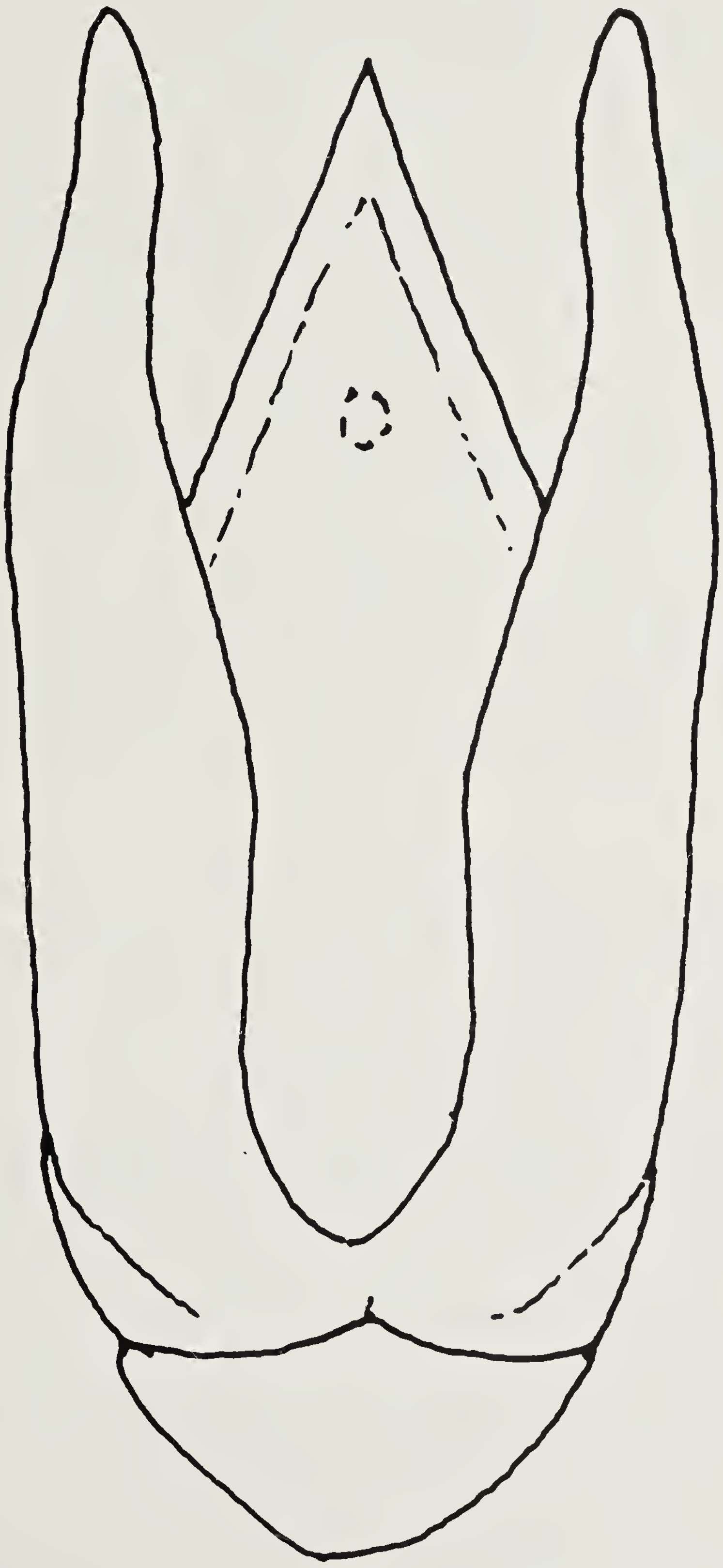

Figure 1. Genitalia of *Paracymus armatus* lectotype.

Reference to the type of this species in the British Museum (Natural History) revealed that all members of that series had the pale border diffusely defined. One member of the type series is a dissected male, and it is this specimen here designated lectotype.

***Paracymus armatus* (Sharp)**

Hydrobius armatus Sharp, 1882: 64.

LECTOTYPE, here designated: Male. Chontales, Nicaragua Jansen. British Museum (Natural History).

Description: Length 1.8 mm, width 1.0 mm, form elongate, oval. Head shining black, lightly bronzed; punctation fine and sparse. Pronotum dark testaceous on disk, lighter toward sides, yellow-brown along margins; punctation very faint; posterior angles rounded. Elytra dark testaceous on disk, broadly lighter on sides, gradually shading to yellow-brown at apex; punctation sparse, slightly more impressed than on pronotum. Venter dark testaceous. Maxillary palpi light testaceous, except last segment darker at tip. Labial palpi light testaceous. Antennae light testaceous, except club dark testaceous; seven segmented. Legs red-brown, except knees and tibia yellow-brown on first pair. Mesofemora pubescent on basal 2/3. Protarsi unmodified. Prosternal carina laminate across entire width. Mesosternal lamina well developed and reaching the mesosternal crest. First abdominal segmant carinate across width. Aedeagus broad and flat, tapering for about 1/3 its length to an acute point. Parameres rounded at tip; inner, upper margin sinuously curved, outer margin straight along 3/4 its length, then curving slightly inward at tip. See Figure 1.

The lectotype also bears a label: B. C. A. Col. I. 2.

ACKNOWLEDGEMENTS

I wish to thank Mr. J. Balfour-Browne and Dr. R. D. Pope, both of the British Museum (Natural History), the former for examining the type series for me, and the later for graciously lending me the specimen here designated as lectotype.

LITERATURE CITED

SHARP, D. 1882. Biologia centrali-americana. Insecta. Coleoptera 1 (Part 2), pp. xv + 140, 4 pls.

FIELD NOTE

An unusual concentration of Anobiidae.—In the evenings of June 19, 21, and July 8, 1968, my wife Janice and I collected, by hand, 124 specimens of Anobiidae. The area of collection is rather low, moist ground beside a small stream 5 miles south of Alexandria, Virginia, and is partially wooded with typical deciduous trees, and fairly open areas of weeds and marsh grasses. The collecting took place between 7:00 and 8:40 P.M. and totalled 80 minutes for the three evenings. The beetles were on the low foliage of dogwood, sweet gum, walnut, oak, and other plants. The greatest concentration was on the dogwood with over half of the total number of specimens from leaves of this plant; they were second in numbers on sweet gum. The beetles were resting or walking about on the surface of the leaves, and none were seen to be feeding or mating. All of the beetles were found within a radius of about 10 feet, and within a few inches to nearly six feet above the ground. Nearby areas of similar plant composition were examined but no concentration of Anobiidae was found. Collecting was attempted after the above dates but with little or no success.

(Continued on Page 108)

A Comparison of Silphids Taken From Covered and Uncovered Carrion (Coleoptera: Silphidae)[1]

BRETT C. RATCLIFFE[2] AND ROBERT J. LUEDTKE

DEPARTMENT OF ENTOMOLOGY
UNIVERSITY OF NEBRASKA
LINCOLN, NEBRASKA 68503

INTRODUCTION

As an extension of the silphid research by the senior author, an experiment was conducted to ascertain the differences, if any, in silphid species that would be attracted by placing covered and uncovered animal carcasses in the field. A review of the literature indicated that nothing has been published in this regard.

In eastern Nebraska silphids are very active in the spring, their numbers being greater at this time of year than at any other. University of Nebraska Entomology Museum records show that 14 species have been taken in Lancaster County.

Two tests were conducted at Steven's Creek, three miles east of Lincoln, Lancaster Co., Nebraska. This area was selected because silphids were frequently found there in 1968. The habitat of the vicinity consists of gently rolling farm land with small wooded areas and windbreaks throughout the area; trees are found along the streams. The weather during the study period was warm and sunny with a few night showers.

METHODS

In the first test four freshly killed piglets were placed in pairs, 30 yards apart, near a gravel road. One pair was covered with a large piece of tree bark whereas the other was left uncovered. In the second test two freshly killed adult racoons were placed 15 yards apart. One carcass was covered with tree bark as in test one, and the other was left uncovered. The carcasses were observed daily for adult silphids during the next 20 and 11 days, respectively. Beetles were collected when present.

RESULTS AND DISCUSSION

In our experiments *Nicrophorus orbicollis* Say was found only on covered carrion even though uncovered carrion was near (Table 1). *N. orbicollis* are

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[1] Published with the approval of the Director as paper no. 2675, Journal Series, Nebraska Agricultural Experiment Station, and Contribution no. 327 of the Department of Entomology, University of Nebraska, Lincoln, Nebraska 68503.

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[3] Student, Department of Entomology, University of Nebraska, Lincoln, Nebraska 68503.

Table 1. Silphids taken from piglet carcasses. Number of each species taken are shown in brackets.

Day	Covered	Uncovered
April 28	0	0
29	0	0
30	0	*S. inaequalis* (7) *S. lapponica* (1) *S. truncata* (1)
May 1	*N. orbicollis* (2)	*S. inaequalis* (2)
2	*N. orbicollis* (3) *N. pustulatus* (1)	0
3	0	0
4	*N. orbicollis* (2)	*S. inaequalis* (7) *S. lapponica* (2) *S. noveboracensis* (2) *S. truncata* (23)
5	*N. orbicollis* (1)	0
6-8	0	0
9	0	*S. inaequalis* (1) *S. noveboracensis* (1) *S. truncata* (5)
10-17	0	0

Table 2. Silphids taken from racoon carcasses. Numbers of each species taken are shown in brackets.

Day	Covered	Uncovered
May 12	0	0
13	0	*N. surinamensis* (7) *S. truncata* (2)
14	0	0
15	0	0
16	*N. surinamensis* (13)	*S. noveboracensis* (1) *S. truncata* (1)
17	*S. inaequalis* (1)	*S. noveboracensis* (2) *S. truncata* (2)
18-19	0	0
20	*S. truncata* (1)	0
21	0	0
22	0	*S. noveboracensis* (1)
23-24	0	0

Table 3. Total number of each species taken from both tests.

Species	Covered	Uncovered
N. orbicollis	8	0
N. pustulatus	1	0
S. inaequalis	1	17
S. truncata	1	34
S. lapponica	0	3
S. noveboracensis	0	7
N. surinamensis	13	7
7 species	24	68

commonly found on uncovered carrion under normal conditions. They were not found on either carcass in the second test because of probable seasonal termination of the first generation adults.

Except for two instances *Silpha inaequalis* Fab. and *S. truncata* Say were found only on uncovered carrion (Table 2). *S. noveboracensis* Forst. and *S. lapponica* Hbst. were found only on uncovered carrion. *Necrodes surinamensis* Fab. was found beneath both covered and uncovered carcasses in test two. *N. pustulatus* Hers. was found one time on covered carrion (Table 1).

A total of eight *N. orbicollis,* one *N. pustulatus,* one *S. inaequalis,* one *S. truncata* and 13 *N. surinamensis* were taken from covered carrion. Three *S. lapponica,* seven *S. noveboracensis,* 17 *S. inaequalis,* 34 *S. truncata* and 7 *N. surinamensis* were taken from the uncovered carcasses. These data indicate that there may be a significant difference in the attractiveness of covered and uncovered carrion.

Erratum

J. E. Lloyd. Coll. Bull. 1969, 23 (2) : p. 37, 3rd. paragraph, 2nd. line—not "a synonym", but "synomyms".

Violent Deaths of Podabrus[1] (Coleoptera: Cantharidae)

KENNETH M. FENDER

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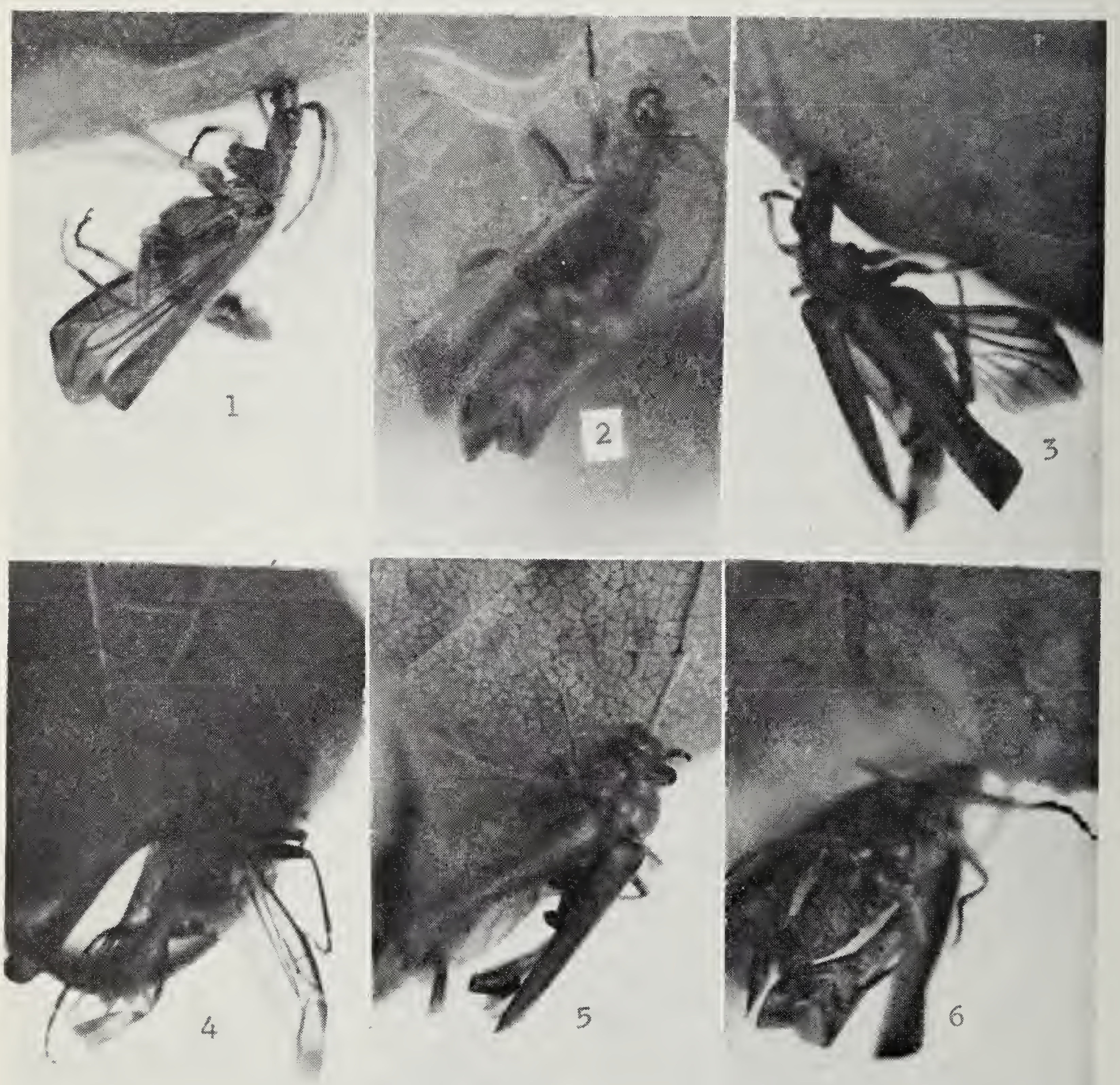
How often is it that an entomologist travels extensively in search of phenomena in his favorite groups, only to have one occur in his back yard (side yard in this case)? Such a situation confronted me this spring (1969) following the annual flight period of *Podabrus pruinosus* LeConte in the area.



Figures 1-6, Dead *Podabrus* attached to leaves by mandibles. Fig. 1, Lateral view of specimen showing abdomen thrust up; between wings and torn near apex, legs elevated. Fig. 2, Same specimen, latero-dorsal view, biting vein of leaf. Figs. 3, 4, and 6, Other specimens. Fig. 5, Specimen with abdomen missing.

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[1] This study was supported by National Science Foundation grant: GB-6283X.

As I strolled meditatively in the side yard of my home, I noticed a dead *Podabrus pruinosus* in the underside of a leaf of a cork elm. It was grasping one of the main veins of the leaf with its mandibles. The abdomen was strongly thrust up between and separating the wings and elytra. Its hind legs were raised from the leaf. Later on it was ascertained that a piece had been bitten or torn from the side of the abdomen.

Before long, another was discovered similarly killed, then another and another, all *P. pruinosus.* Over twenty specimens, so killed, were found. They were mostly on cork elm, with a few on white oak and one on an ornamental dogwood. In nearly all instances the beetles were on the underside and near the edge of the leaf and in all cases were biting one of the larger veins of the leaf. All indications were that they were vainly trying to avoid the violent death that awaited them. All had a piece bitten or torn from the side of the abdomen. In a couple of instances the abdomens were entirely torn away. I do not know whether this removal was by the original predator or not. Possibly some later passer-by may have seen fit to partake of an available delicacy.

It may be that these are some of the more fortunate individuals that escaped a fate worse than death, that of becoming a host to the early stages of the attacker. They were tenaciously avoiding being taken as is evinced by the accompanying photographs.[2]

Unfortunately these observations were made after the annual flight period of *P. pruinosus.* The specimens had been dead for some time. Therefore, I have no clue as to the killer involved.

Never having observed this phenomenon of *Podabrus* before, I don't know whether it is a common occurence or not. I would think not, at least locally, or surely one of my family would have noticed and mentioned it. They are quite observant and interested in my work. Attempts will be made to ascertain the predator involved during the flight period of *P. pruinosus* next season.

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[2] Photography by my son, William M. Fender.

FIELD NOTE

(Continued from Page 102)

Identification has shown the specimens to consist of 5 genera and probably 10 species as follows (numbers of each given): *Tricorynus rotundus* White—7; *T. dichrous* (Fall)—5; *T. confusus* (Fall)—1; *Protheca hispida* Lec.—12; *P. puberula* Lec.—3; *Petalium bistriatum bistriatum* (Say)—18; *P. seriatum* Fall—3; *Eutylistus intermedius* (Lec.)—7; *Caenocara oculata* (Say)—39; *C.* probably *oculata* (Say)—25; and *C. tenuipalpa* Fall—4.

Anyone who has collected beetles extensively will recognize the unusual nature of the above record. It is very infrequent that one is able to collect a variety of Anobiidae in large numbers, even for one as myself, who has concentrated on collecting them for some years.—Richard E. White, *Systematic Entomology Laboratory, Entomology Research Division, ARS, U. S. Department of Agriculture, Washington, D. C.*

The Other Sex of *Metamasius spurius* and Extensions of Range of the Genus (Coleoptera: Curculionidae)

PATRICIA VAURIE[1]

On a recent visit (1968) to the Muséum National d'Histoire Naturelle in Paris, I found among some unidentified weevils of the subfamily Rhynchophorinae a male and a female of a species (*Metamasius spurius* Vaurie, 1967, p. 218) known previously from a single male in the Zoologisches Museum, Berlin. This pair was collected in 1893 by M. de Mathan at La Chima, Ecuador, which is not far from the type locality, Balzapamba. The specimens are the same size as the type (12mm.), and have the same large, embossed, red-orange spots on the elytra. They are in perfect condition, in contrast to the type in which the pronotum, due to some mechanical injury, is pushed in at its apex. The female differs from the male only by having the antennae inserted somewhat closer to the eye, the prosternum between the coxae flat, not tumid, and the metasternum at the center only slightly, not deeply, concave. Through the courtesy of the Paris museum, the female is now in the collection of the American Museum of Natural History.

Below are recorded some extensions of range based on specimens examined from the following collections: C. Bordon, Caracas (Venez.); E. L. Sleeper, Long Beach, California (ELS); J. D. Glaser, Baltimore, Maryland (JDG); Field Museum, Chicago (FM); Muséum National d'Histoire Naturelle (MNHN); Museum of Comparative Zoology, Cambridge (MCZ); and University of Michigan, Ann Arbor (UM).

SPECIES GROUP I

Metamasius basilaris Vaurie. The range is extended farther northeast in South America by a female (MCZ) from Cayenne, French Guiana, the former range being from northern Argentina to Brazil in the east and to Colombia in the west.

M. cerasinus Vaurie. This species from Panama and northern South America occurs as far south as Beni Province, Bolivia, according to a female (FM) collected by Borys Malkin in July, 1960, at a Chacobo Indian village on the Rio Benecito.

M. ciliatus Champion. Formerly known from Mexico only, this species has been found in Guatemala (MCZ).

M. hemipterus carbonarius Chevrolat. The most northern record was from the state of Colima, Mexico, at about 20° lat., but I have now seen a female (ELS) from San Blas, Nayarit, at 21° 31', collected December, 1962, by A. Hardy.

M. h. hemipterus Linnaeus and *M. h. sericeus* Olivier. In 14 specimens (Venez.) from six localities in the vicinity of Caracas and Lake Maracaibo—an area of supposed intergradation of these two subspecies—the coloring is pheno—

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[1] Research Associate, American Museum of Natural History, New York City.

typically *h. hemipterus.* Two of eight specimens from Caucagua show how variable the pattern of this species can be, as the left elytron is striped with red as in nominate *hemipterus,* but the right elytron is entirely black as in *M. hemipterus carbonarius* Chevrolat.

M. maurus Gyllenhal. The most southern record for this species is from Grenada (JDG) in the Lesser Antilles, the former range being from St. Vincent north to Guadeloupe.

M. quadrilineatus Champion. A more southern locality for this species is Mt. Camp, west of San Pedro Sula, Honduras, represented by a female (FM), collected in May, 1923, by Schmidt; the species was known from El Salvador north to southern Mexico.

SPECIES GROUP III

M. fahraei Gyllenhal. Some specimens of this species from the isthmus of Tehuantepec (Mathias Romero, Salina Cruz, and Tehuantepec), Mexico, have very large elytral foveae, and are referred to the subspecies *striatoforatus,* which is generally black, but I have now seen two which have red bands as in nominate *fahraei* (MCZ), also from the isthmus, but without exact locality.

M. limulus Vaurie. A female (MCZ) of this Ecuadorean (Vaurie, 1968) and Brazilian species extends the range to the northeast to Cayenne.

M. saguinolentus Olivier. The range of this species from southern Mexico to Colombia is now extended farther south to La Chima, Ecuador, according to a male and female (MNHN) from that locality.

M. spinolae validus LeConte. This subspecies of Sinaloa and Baja California, Mexico, and California is found as far north as San Francisco (UM).

LITERATURE CITED

VAURIE, P. 1967. A revision of the neotropical genus *Metamasius* (Coleoptera, Curculionidae, Rhynchophorinae). Species group III. Bull. Amer. Mus. Nat. Hist. 136: 175-268.

.... 1968. Distributional notes on *Metamasius* (Coleoptera: Curculionidae). Journ. N. Y. Ent. Soc. 76: 32-33.

A New Species of Telegeusidae (Leng) from Panama (Coleoptera: Cantharoidea)[1]

by

ROBERT T. ALLEN[2] AND ROBERT S. HUTTON[3]

The genus *Telegeusis* Horn is one of two genera belonging to the family Telegeusidae. Characters common to the members of the family Telegeusidae indicate that their affinities are with other groups in the superfamily Cantharoidea, a taxon of the order Coleoptera (Barber, 1913; Crowson, 1955; Arnett, 1963). Three species, (*T. dibilis* Horn, *T. nubifer* Martin, *T. schwarzi* Barber), have been described and placed in *Telegeusis*. Members of this genus have been collected in the dry region of southern Arizona, Baja California, and the Sonoran Desert region of Mexico. This paper describes a new species of *Telegeusis* from an environment totally different from those previously reported.

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[1] Published with the approval of the Director, Arkansas Agricultural Experiment Station.

[2] Entomology Department, University of Arkansas, Fayetteville, Arkansas.

[3] United States Army Tropic Test Center, Fort Clayton Canal Zone.

METHODS

Specimens of the new species were collected at black light traps in the Albrook Forest located in the Panama Canal Zone. This forest, the traps used, and other pertinent information will be described at a later date.

In order to study the male genitalia, the last 2-4 abdominal segments were removed and cleared in a heated 10% KOH solution. After clearing, these segments were placed in alcohol to remove any remaining internal contents and then placed in glycerine for study. After examination, they were transferred to genitalia capsules and put on the pins with the pointed specimens. Drawings were made with the aid of a Camera Ludica attacked to a steromicroscope at a magnification of 40 X.

Telegeusis panamaensis **new species**

DESCRIPTION:

Form slender, elongate, small. Entire body covered with numerous short erect hairs. Head, antennae, palpi, pronotum, elytra, abdomen and distal parts of legs usually dark brown (much darker in color than previously described species of *Telegeusis*); ventral surface of pronotum and basal parts of legs light yellow. The general anatomical parts appear to be the same as those described for the genus (Horn, 1895). Head, pronotum, and elytra as for *T. nubifer* and *T. schwarzi*, but smaller. Size, *T. panamaensis* based on 10 specimens in alcohol; *T. nubifer* based on 10 dry specimens on points; numbers in parentheses are ranges; all measurements in millimeters:

	Total Length	Length of Pronotum	Width of Pronotum	Width Across Eyes
T. panamaensis	3.5 (3.1-3.7)	.4 (.3-.4)	.6 (.5- .7)	.7 (.6- .7)
T. nubifer	5.4 (4.6-7.0)	.7 (.6-.7)	.9 (.7-1.1)	1.0 (.8-1.2)

Genitalia (Figs. 1A, 1B, 1C): .8 mm., approximately one-half the size of *T. nubifer:* the lateral lobes in the apical ½ are slightly indented on both the external and internal lateral margins, basal ½ becoming very slender; the spined area on the dorsal surface of the lateral lobes not as large as in *T. nubifer:* dorsal membranous area of lateral lobes without setae: otherwise as for *T. nubifer:* and *T. schwarzi.*

Seasonal distribution: Specimens have been collected in all months of the year except January.

Deposition of type materials: All specimens collected at a black light trap in the Albrook Forest, Panama Canal Zone. Holotype: Male, collected June 8-9, 1967, by R. S. Hutton and L. Llaurado, deposited in the Museum of the Entomology Department, University of Arkansas. Fifty-one male paratypes deposited as follows: 8 paratypes, Floyd Werner, the University of Arizona;

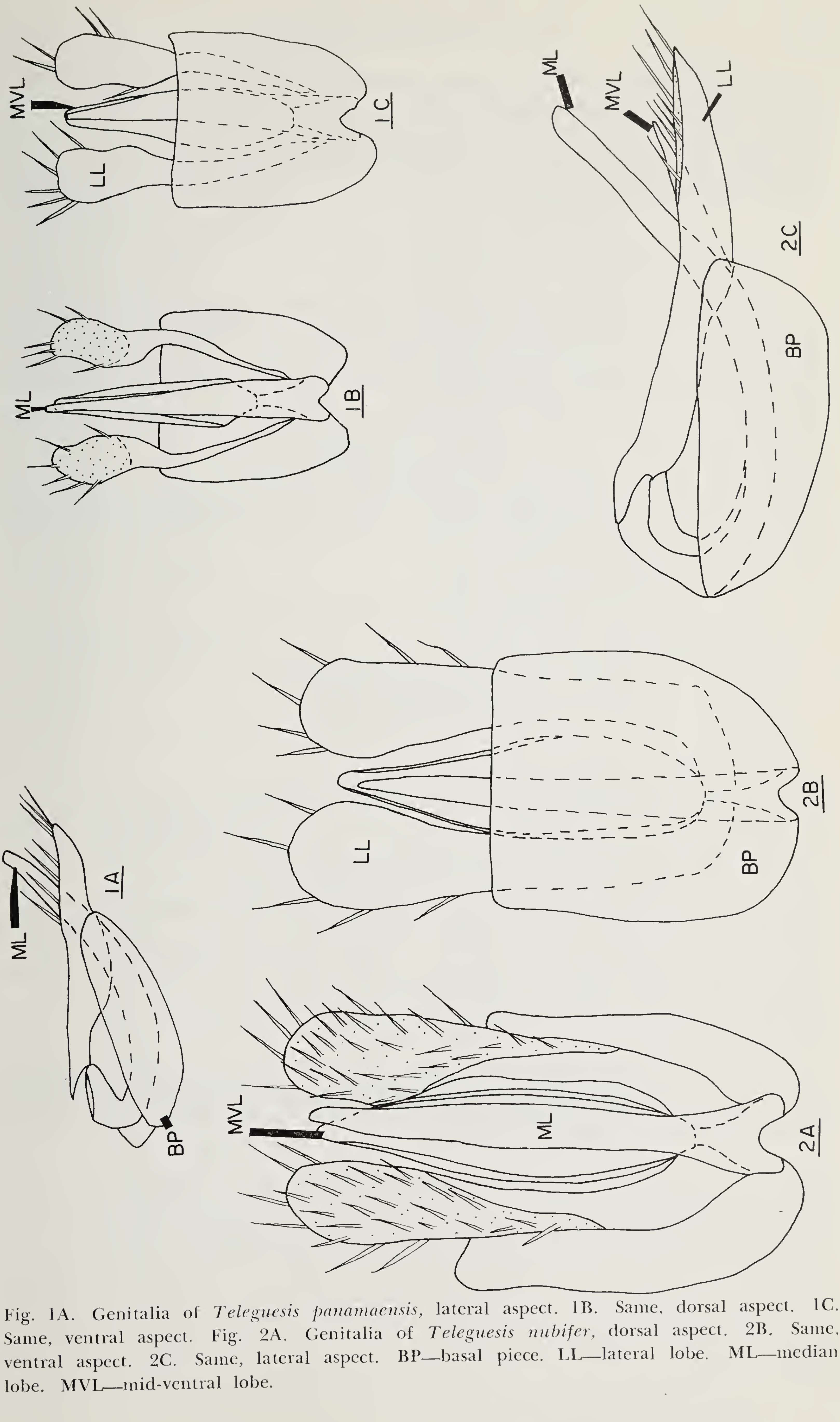

Fig. 1A. Genitalia of *Teleguesis panamaensis,* lateral aspect. 1B. Same, dorsal aspect. 1C. Same, ventral aspect. Fig. 2A. Genitalia of *Teleguesis nubifer,* dorsal aspect. 2B. Same, ventral aspect. 2C. Same, lateral aspect. BP—basal piece. LL—lateral lobe. ML—median lobe. MVL—mid-ventral lobe.

2 paratypes to each of the following institutions: American Museum of Natural History, Museum of Comparative Zoology, United States National Museum, Illinois State Natural History Survey, California Academy of Sciences, British Museum (Natural History); 31 paratypes, Museum of the Entomology Department, University of Arkansas.

DISCUSSION

The three diagnostic characters that distinguish *T. panamaensis* from all other species in the genus are (1) its smaller size, (2) the shape of the lateral lobes of the aedeagus and (3) the darker coloration. Although we have not seen any specimens of *T. dibilis*, the greater length of the elytra as illustrated by Horn (1895) and confirmed by Barber (1953) separates this species from others of *Telegeusis*. The genitalia of *T. schwarzi* appear to be identical with those of *T. nubifer*. *T. schwarzi* will not be synonymyzed at this time however, because sufficient material has not been studied. The following key to the species of *Telegeusis* has been modified from Barber (1953) to accomodate the new species *T. panamaensis*.

KEY TO THE KNOWN SPECIES OF TELEGEUSIS

1. Elytra tapering, narrow, subacute and long, extending one-third their length beyond the hind coxae; head much longer than the pronotum. Sierra San Lazaro, Baja California (?10 mi. NW of San Jose del Cabo) ---------- **T. dibilis** Horn
   Elytra short, acutely truncate, not extending beyond apices of hind coxae; head but little longer than pronotum ---------- 2
2. Color, generally dark brown; small, total length never exceeding 3.7 mm; lateral lobes of aedeagus indented on both the external and internal lateral margins (Figs. la, 1b, 1c). Panama ---------- **T. panamaensis** Allen & Hutton
   Color, light to pale yellow; larger, total length never under 4.6 mm; lateral lobe of aedeagus with both external and internal lateral margins straight (Figs. 2a, 2b, 2c) ---------- 3
3. Elytra reaching apices of hind coxae or about a third longer than wide across the humeri; their apices infuscate. Arizona and Baja California ---------- **T. nubifer** Martin
   Elytra shorter, their apices reaching only to base of hind coxae and not infuscate, the width across humeri nearly equal to elytral length. Central Arizona ---------- **T. schwarzi** Barber.

ACKNOWLEDGMENTS

The authors would like to thank Dr. Floyd Werner for loaning specimens of *T. nubifer* and *T. schwarzi*. We would also like to thank Dr. Lee Herman for making certain literature available.

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7. Directory of Coleoptera Collections of North America. Edited by R. H. Arnett and G. A. Samuelson. CSC, Department of Entomology, Purdue University, Lafayette, Indiana 47907. $3.95 postpaid.
8. Photographic prints, copies from data files, reprints of journal articles, by inquiry to CSC, Department of Entomology, Purdue University, Lafayette, Indiana 47907.
9. Studies on Speciation No. 1: The taxonomy and speciation of Pseudophonus. Institute for study of Natural Species, 550 Elston Road, Lafayette, Indiana 47905. $3.95.

Notices

ANOBIIDAE: Assembling world-wide collection. Now studying Papuan Sub-Region species. Will exchange for Coleoptera (all families) from E. United States. E. J. Ford, Jr., Rm. 506, 123 S. Gay St., Baltimore, Md. 21202.

CHRYSOMELIDAE: Revising *Systena* (Alticinae) of America north of Mexico; wish to borrow material. Eric H. Smith, Dept. of Entomology, Purdue University, Lafayette, Indiana 47907.

TENEBRIONIDAE: Revising tribe Asidini. Would like to borrow material. Especially interested in associated immatures, and biological observations. Kirby W. Brown, Dept. of Entomology, Univ. of Calif., Riverside, Calif. 92502.

CARABIDAE: Will exchange French beetles of families Scarabaeidae, Histeridae, Buprestidae, Chrysomelidae, Coccinellidae, Anthicidae, Tenebrionidae, and water beetles for U. S. Carabids. Jacques Negre, 9, Bd. De Lesseps, Versailles, France.

SCARABAEIDAE: Interested in obtaining specimens of the genus *Coenonycha* for research and in building up a collection of scarab genera from the U.S.A. Exchange. Mrs. Jean Davidson, Dept. of Entomology, Oregon State University, Corvallis, Ore. 97331.

BUPRESTIDAE: Will exchange specimens and determine *Chrysobothris* from southwestern U.S.A. Jerry Davidson, Dept. of Entomology, Oregon State University, Corvallis, Oregon 97331.

CARABIDAE, SCARABAEIDAE: Collect, exchange. William D. Harding, 4365 Midland, Drayton Plains, Mich. 48020.

SCARABAEIDAE: Limited number of *Pleocoma badia* available. Terry W. Taylor, 8529 Norwood Pl., Rosemead, CA 91770.

ELATERIDAE: Revising *Physorhinus*, wish to borrow pinned or alcohol material. D. Schaaf, Dept. of Entomology, Purdue University, Lafayette, Indiana 47907.

STAPHYLINIDAE: Currently beginning study of taxonomy and morphology of larvae and adults of the Staphylinid subfamily Leptotyphlinae. Would like to borrow specimens in this group from North America primarily, but would welcome material from Central or South America. J. F. Cornell, Ass't Prof. of Biology, Appalachian State University, Boone, N. Car. 28607.

TENEBRIONIDAE: Will exchange South American, Andean, and desert forms for any other groups of insects from Chili. Luis. D. Pena, G.P.O. Box 2974, Santiago, Chile.

CICINDELIDAE: Interested in obtaining specimens of Cicindela trifasciata peruviana from Peru and Ecuador. Will exchange for other Chilean species. Luis E. Pena, G.P.O. Box 2974, Santaigo, Chile.

SCARABAEIDAE, CERAMBYCIDAE, LUCANIDAE: Goliath beetles, 14 different aberrations; 200 other species of beetles; for sale. Russell Dunn, Box 468, Sedona, Arizona, 86336.

VIET NAM COLLECTION: Will exchange recently collected material from S.E. Asia for material from Southwestern U.S.A. Anyone wishing to determine material from this collection may keep the determined specimens. Bruce W. Miller, Dept. of Biological Sciences, Univ. of Nevada at Las Vegas, Las Vegas, Nevada, 89109.

COLEOPTERA of the Northeastern USA, identified, papered. Wish to give away or exchange. N. M. Downie, 505 Lingle Terrace, Lafayette, Ind., 47901.

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PROFFESSOR OF ENTOMOLOGY AT PURDUE UNIVERSITY

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